Archives of PHYSICAL THERAPY, X-RAY, RADIUM

(Incorporating PHYSICAL THERAPEUTICS)
with
INTERNATIONAL ABSTRACT

Official Journal American Congress of Physical Therapy

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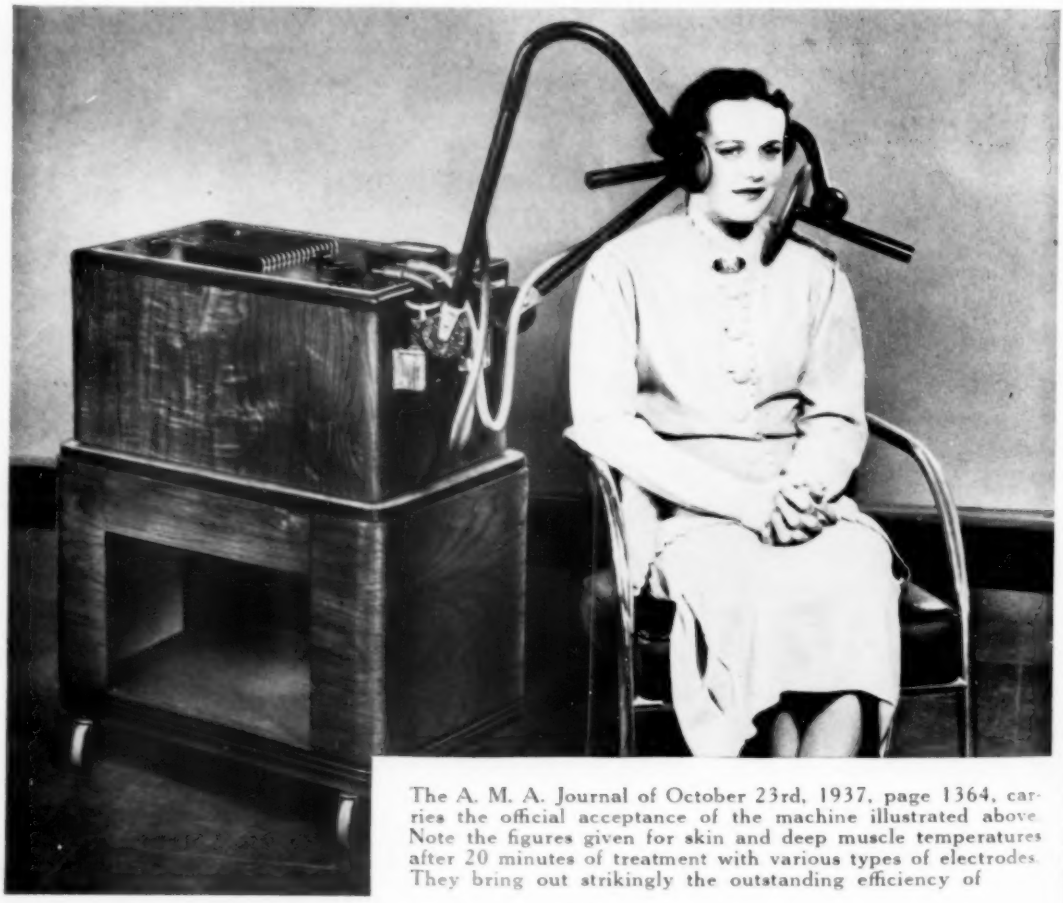
Lepel Portable Short Wave Machine

ACCEPTED BY A. M. A.



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Contents—Nov. 1937

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ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

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EFFECT OF HEAT APPLIED BY THE ELLIOTT TREATMENT AND SHORT WAVE DIATHERMY ON BLOOD AND LYMPH FLOW OF INTESTINE AND COLON *

(An Experimental Study in the Dog)

C. R. SCHMIDT, M.S.; J. M. BEAZELL, M.S., and A. C. IVY, Ph.D., M.D.

CHICAGO

Heat, as a therapeutic agent, has occupied for many years a prominent and meritorious position in therapeutics. During the past decade new physical methods for applying heat to, and of producing heat in, the body have been introduced in physical therapy. Some of these methods are designed so as to apply the heat locally without raising the body temperature, and others to raise the body temperature.

The Elliott treatment regulator is one of the newer devices for the local application of heat. For example, in treating pelvic inflammation a specially constructed rubber bag is inserted into the vagina or rectum and water at a controlled temperature is circulated through the bag. Undoubtedly this is an effective method for applying heat to the pelvic parts. Another physical method that has been used is short wave diathermy. For example, in the case of pelvic inflammation the electromagnetic current is applied to the pelvis. The question which naturally arises is: Do the two methods produce the same or different effects on the tissues? Or, do the physiologic effects of these two methods differ?

When heat is applied to the skin a visible active hyperemia results. The extent of this form of active hyperemia has been measured by direct methods in only one instance. Woltson[1] has observed that heat applied to the hind limb of the dog increases the volume flow of blood through the limb. The effect of hyperpyrexia on blood flow has been studied by indirect methods by Kissin and Pierman,[2] Kopp,[3] Johnson, Osborne and Scupham,[4] and Gesenius,[5] all of whom observed a similar increase. The effect of heat on the blood and lymph flow of visceral organs has not been studied by any quantitative method; and in pelvic infections certain visceral organs, too, are concerned. Neither is much information available concerning the resistance of mucous membranes to the local application of heat. Whether the mucous membranes are more or less resistant to heat injury than the skin is a question that has not been studied.

This investigation was undertaken to answer the following questions: (a) What is the effect of the application of heat by the Elliott method and by short wave diathermy on the blood flow through a loop of intestine or colon? (b) What is the effect of these two methods on lymph flow? (c) What is their effect on the secretory activity of the mucous membranes? (d) What degree of temperature is required to injure mucous membranes when the Elliott method is employed?

Experimental Data

Since the Elliott method is used to apply heat to the mucous membranes of the various body orifices it would have been desirable to use one of these orifices as a test organ. Accordingly considerable time was devoted to sur-

* Aided by a grant from the Council on Physical Therapy of the American Medical Association.
* From the Department of Physiology and Pharmacology, Northwestern University Medical School, Chicago.

mount the technical difficulties required to obtain quantitative results from such orifices as the vagina and rectum, and organs as the prostate and urinary bladder. Because of the large amount of operative work required to exclude collateral circulation, and other technical difficulties (for example, the engorgement of the blood vessels of the urinary bladder and the prostate when these organs are manipulated), this approach to the problem was abandoned.

It should be emphasized that in a quantitative study of this kind it is essential that the observations be made upon organs from which the complete venous return can be collected. At the same time the experimental procedure must be such that normal physiologic activity remains unimpaired. The distribution of blood supply to most mucous membrane-lined organs is such that these requirements cannot be fulfilled. However, segments of the small intestine and colon readily lend themselves to such a procedure. Because of the arcuate distribution of blood vessels these viscera are actually a continuous series of anatomic units and it is possible to collect all of the venous blood and lymph from a segment of intestine 12 to 18 centimeters in length, with no passive congestion in the segment and with the arterial supply entirely intact.

Measurement of Blood Flow and Intestinal Secretion. — The rate of blood flow was determined by quantitative collection of venous blood from the small intestine and colon of heparinized dogs under nembutal anesthesia. The procedure in detail was as follows: A femoral vein was cannulated and connected to a paraffin-lined funnel by an oiled rubber tube. This served as a means for returning blood to the animal. A segment of the small intestine, or the proximal two-thirds of the colon, was isolated so that a single mesenteric vein drained the segment. A short piece of tubing was purse-stringed into the distal portion of the segment to provide drainage for intestinal secretion. In the studies where heat was applied locally a loop of intestine was exteriorized, using care to avoid tension or twists in the mesentery; the segment was kept moist and at body temperature. Heparin (10 to 15 mg. per kilo) was then injected intravenously and the vein draining the segment was cannulated with a glass cannula having a lumen comparable in size to that of the distended vein. The time required for 30 to 50 cc. of blood to drain into a paraffin-lined collecting cylinder was measured by stop watch and the blood was immediately returned to the systemic circulation by way of the cannulated femoral vein. In this manner a continuous flow of blood was maintained with no significant decrease in the circulating blood volume.

This procedure was slightly modified in the diathermy experiments where heat was applied over a large area. In these studies the isolated segment with the cannulated mesenteric vein was left in the abdomen, the rubber tubing connecting the mesenteric vein cannula and collecting cylinder was led out through a stab wound, and the abdominal incision was closed.

In all successful experiments venous congestion was absent as evidenced by the pink, normal appearance of the isolated segment. Heparin, in the concentration used, effectively prevented the clotting of blood in any part of the system. In all blood flow studies determinations were made continuously over a two and one-half hour period. The rate of blood flow during the first thirty minute *control period* was considered as the basal rate of flow; the second and third thirty minute intervals constituted the *heat period*, during which heat was applied; and the fourth and fifth thirty minute intervals served as the *post-heat period*. Control experiments without the application of heat were also performed.

Measurement of Lymph Flow. — The effect of heat on lymph flow was determined by the direct collection of lacteal or thoracic duct lymph five hours after a fat meal. As in the blood flow studies, the experimental period lasted two and one-half hours, and the second and third thirty minute intervals constituted the "heat period."

Results

In order to conserve space only average values will be listed except when otherwise noted. This is possible since the individual variation in response was not great enough to necessitate the recording of individual experiments.

(a) *The Local Application of Heat.* — Heat was applied to the intestinal lumen by means of the Elliott treatment regulator, which consists of a thermostatically controlled water bath and an electrically driven pump which circulates the heated water through a slightly distensible, gum rubber applicator. The applicators are interchangeable so that the size and shape can be varied to conform to the lumen of the organ to be treated.

1. *Experiments on Blood Flow.* — When blood flow was followed for 2½ hours with the applicator filled with tepid water, in place but without the application of heat, the rate of flow gradually diminished after the first forty-five minutes (fig. 1). When heat was applied, after establishing a basal rate of flow, the blood flow was invariably accelerated. In figure 1 is shown a composite curve of the results obtained on 7 dogs when heat was applied to the lumen of the small intestine. For comparison, the results on 3 untreated dogs and on 5 dogs treated with short wave diathermy are also shown. It will be noted that a latent period of 15 to 30 minutes preceded the accelerated blood flow; this was a constant feature whether the heat was applied externally by diathermy or internally by means of a heated applicator. The greatest response to local application of heat occurred 30 minutes after the beginning of the treatment, when the blood flow reached an average rate of 33½ cc. per minute. During the remaining 30 minutes the rate of flow gradually decreased. During the one hour "post-heat" period the rate of flow continued to diminish, so that by the end of the hour the blood flow was again at the basal level. In contrast, the non-heat treated group showed a gradual decline in the rate of flow from 15 cc. per minute during the basal period to 2 cc. per minute at the end of 2½ hours (fig. 1). The treated segments were grossly normal in all of the experiments; microscopically, small areas of mucosa were denuded of epithelium and erythrocytes were present in the tissue spaces. When the intestinal segments were treated at temperatures higher than 52.2 degrees C., or when the rubber applicator was large enough to distend the segment, tissue damage almost always resulted. In one instance in which a relatively small applicator was used, an applicator temperature of 57.8 degrees C. was tolerated. *Injury was accompanied by a characteristic blood flow response.* In three experiments in which higher temperatures were employed (54.4, 55.5, and 57.8 degrees C.) the increase in blood flow was less than that observed at 52.2 degrees C., and following the injury the rate of flow rapidly declined to a level much lower than the basal.

Experiments on the colon gave results comparable to, but of less magnitude than those obtained on the small intestine. Because of the greater contractility and relatively less abundant blood supply, the colon was damaged at temperatures lower than that required to injure the small intestine; in several instances a temperature of 52.2 degrees produced burns.

2. *Temperature of the Treated Segments.* — The temperature of the mucosa of the segments was not directly recorded; however, a thermometer

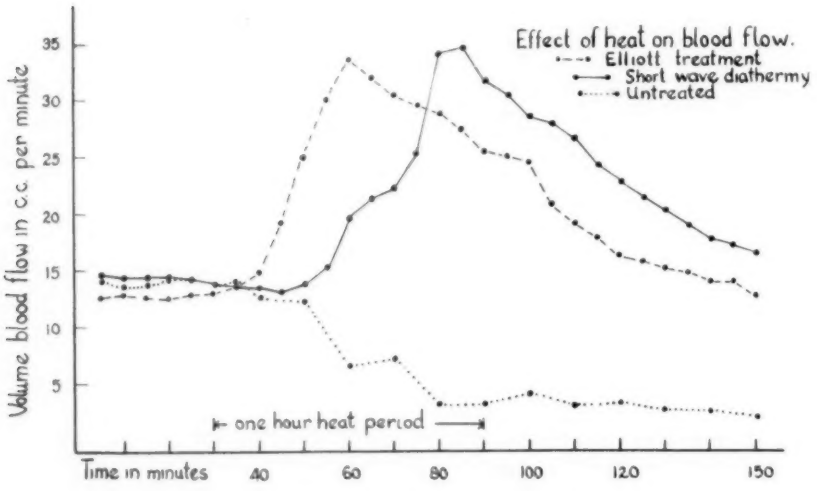

Fig. 1. — For explanation of above chart, see also text.

purse-stringed into the lumen of the segment recorded the temperature of the intestinal juice. It is significant that the temperature of the intestinal juice, when the temperature within the applicator was 52.2 degrees C., was never more than 1.6 degrees higher than the rectal temperature of the animal. The highest temperature recorded in the intestinal secretion was 39.5 degrees C. Undoubtedly the superficial cells of the mucosa were heated to temperatures higher than 39.5 degrees C., yet because of the markedly increased volume of blood flowing through the heated tissue, the temperature of the segment as a whole was not measureably raised. The body temperature was not significantly elevated or changed by the Elliott method.

3. *Formation of Succus Entericus.* — The secretion of succus entericus was markedly stimulated by heat applied by the Elliott method in all experiments. Average values from seven observations on the small intestine (temperature 52.2 degrees C.) were: Basal period, 0.7 cc. per hour; one hour heat period, 10.8 cc. per hour; one hour post-heat period, 10.0 cc. per hour. In experiments where lesions resulted from temperatures higher than 52.2 degrees C. an even greater volume of blood tinged intestinal secretion was obtained.

4. *Experiments on Lymph Flow.* — In regard to lymph flow, heat at a temperature of 52.2 degrees C. applied to the intestinal lumen for one hour produced no quantitative change in the rate of lacteal lymph flow in any of eight experiments. Likewise, heat applied to the gastric mucosa by means of a balloon-shaped applicator failed to increase the flow of thoracic duct lymph in any of four experiments. In one experiment in which tissue damage was unintentionally produced, an increased flow of watery, blood-tinged lymph was observed.

(b) *The General Application of Heat.* — Hyperpyrexia was induced by short wave diathermy, using the General Electric inductotherm with a cable applicator. The electromagnetic field was applied by encircling the abdomen of the experimental animals with three coils of the cable.

1. *Experiments on Blood Flow.* — In these experiments heat was applied to the abdomen during the second and third thirty minute periods, the objective being a body temperature of 41.1 to 41.7 degrees C. (106 to 107 degrees F.). In the anesthetized dog, hyperpyrexia, once attained, is maintained with only a slight change in temperature for at least one hour after

the heat is discontinued. Referring to figure 1 it is evident that during the first half hour of the heat treatment the rate of blood flow remained unaltered. At this time the body temperature had been raised, on an average, to 38.9 degrees C. (102 degrees F.). During the last half hour of the heat period the temperature was raised from 38.9 to approximately 41.5 degrees C. with the result that the blood flow was considerable augmented. As in the experiments where heat was applied locally by means of the Elliott method, the rate of blood flow reached a maximum and then gradually diminished to the level obtained before the heat treatment. The results of short wave diathermy heating compare favorably with those obtained when heat was applied locally by the Elliott method. As shown in table 1,

TABLE 1. — *The Effect of the Elliott Treatment and Short Wave Diathermy on Blood Flow.*

Number of experiments	Treatment	Total volume of blood collected during consecutive 30 minute periods (c.c.) 1	2	3	4	5	Total
3	none	375	340	147	100	73	1035
7	Elliott treatment; temperature 52.2° C.	365	642	885	640	446	2978
5	Diathermy; body temperature raised to 41.5° C.	420	438	822	720	560	2960

approximately three times as much blood flowed through the intestinal segment as the result of the application of heat, whether applied locally or generally.

2. *Experiments on Secretory Activity and Lymph Formation.* — Despite the fact that body temperatures of approximately 41.5 degrees C. (internal viscera temperatures 1 to 2 degrees higher) were accompanied by a marked acceleration of the circulating blood volume, lymph formation and the production of succus entericus were not affected by the short wave diathermy in any of ten experiments. In fact, the flow of thoracic duct lymph tended to be decreased as the result of raising the body temperature to 41.5 degrees C.

In experiments in which hyperpyrexia was produced, in contrast to the experiments where heat was applied locally, the animals exhibited a marked hyperpnea, and the pH of the blood was lowered from an average of pH 7.60 to pH 7.30. Microscopically the treated segments showed no untoward effects as the result of the short wave treatment.

An effort was made to supplement the information obtained on normal tissue by studying the effect of heat on inflamed tissue. Colonic inflammation was induced by giving repeated enemas containing graded concentrations of either croton or mustard oil. However, so many complicating factors were encountered that the production of a satisfactory inflammation proved to be a problem in itself. Therefore, this phase of the investigation was left for future study.

Leukocyte counts made on stained sections of treated tissues and on lymph yielded no conclusive information.

Comment

The phase of this investigation concerned with blood flow requires little discussion since the results, which are quantitative, substantiate qualitatively predictable effects of heat on blood flow. Under optimum conditions both the Elliott treatment and short wave diathermy treatment increase the rate of blood flow two to four times. However, it is of interest to know that in artificial fever the blood flow through the visceral vessels as well as the peripheral vessels is increased. This is contrary to the idea that in

fever the blood is shunted from the viscera to the periphery. Similarly, Herrick and collaborators[5] found, contrary to current belief, that blood is not diverted from somatic tissue to visceral organs during digestion. Thus, during digestion or fever a general increase in the rate of circulation occurs which is associated, undoubtedly, with an increased minute volume output of the heart and a shorter circulation time.

During the course of this investigation certain observations of clinical value were made. It was found that heat must be applied for at least one-half hour to obtain a maximum increased blood flow. The greatest velocity of flow was reached thirty minutes after the beginning of the treatment; during the remainder of the hour the rate of flow remained appreciably augmented but declined slowly. That the gradually diminishing rate (fig. 1) is not due to impairment of physiologic activity was shown by reapplying the heat after the blood flow had returned to normal following a heat treatment. Under such conditions the blood flow was again augmented.

Temperatures that would be destructive to the skin were applied to mucous membranes in this study by the Elliott method with no ill effects unless some factor was present which interfered with venous return. The markedly augmented blood flow, coupled with an initial abundant blood supply, was apparently able to dissipate the heat and thus prevent an appreciable elevation of tissue temperature. This was borne out by the fact that in no instance was the temperature of the intestinal secretion within the lumen of the treated segment appreciably elevated. However, if the applicator distended the segment or if the segment contracted forcibly upon the applicator, a temperature of 52.2 degrees C. produced gross injury to the mucosa. On the other hand, in one instance in which a relatively small applicator was used, an applicator temperature of 57.8 degrees C. failed to cause significant injury. This indicates the importance of choosing an applicator of a size that will not interfere with the blood flow so that heat locally applied may be dissipated. The role that blood flow plays in dissipating heat applied to the skin has been pointed out by Bazett.[6]

From our studies it is evident that when short wave diathermy was used as a source of heat, the blood flow was not increased until the temperature of the tissues had been raised to 38.9 degrees C. (102 degrees F.). When the body temperature was raised to about 41.5 degrees C. (106.7 degrees F.) the maximum effects were obtained. Under the conditions of our experiments blood flow was approximately tripled by either locally applied heat or short wave diathermy. However, the physiologic mechanism responsible for the hyperemia is different in the two instances. Artificial hyperpyrexia results in an increased cardiac output and an augmented rate of flow in general. In contrast, the response to locally applied heat is confined to the treated area; this was shown by blood flow measurements from an untreated segment of intestine adjoining a second similar segment which was heated. In these experiments the characteristic response was obtained in the treated segment, while the rate of flow was not altered in the untreated segment.

The effect of locally applied heat on lymph flow confirms previous observations. Drinker and Field,[7] on the basis of their own work as well as that of others, have concluded that an active increase in lymph flow does not occur until the increased capillary permeability produced by heat has become a pathologic process. In this investigation the only experiment in which an augmented lymph flow was noted was the one in which injury was produced. Likewise, hyperpyrexia caused no change in the rate of lymph formation.

It has been suggested that the beneficial effects of heat in inflammatory conditions may be the result of increased blood and lymph flow which "flushed" out the tissues. Although an increase in blood flow occurs in normal tissues, an increase in lymph flow does not take place. Whether an increase in lymph flow would appear in inflamed tissues on the application of heat is yet to be determined. The decrease in tumefaction resulting from heat might be due either to an increase in blood or lymph flow, or both. The increased circulation rate alone, by improving oxygenation and promoting the removal of noxious substances from the inflamed tissues, should operate to decrease tumefaction and pain, and facilitate local defense mechanisms.

Conclusions

Some effects of the Elliott treatment and short wave diathermy heating were investigated by quantitative methods in the dog. Total venous blood flow from various levels of the gastro-intestinal tract was measured over a two and one-half hour period. Heat applied during the second and third thirty minute intervals increased the blood flow from two to four times, under optimum conditions. In instances where injury was inflicted by the local application of heat the increase in blood flow was less. Mucous membranes can tolerate temperatures that would be definitely injurious to the skin; this is made possible by an active hyperemia of such magnitude that the heat is readily dissipated. Temperatures of about 52 degrees C. applied locally to mucous membranes stimulated secretory activity considerably, while body temperatures of 41.5 degrees C. induced by diathermy had no measurable effect. Lymph formation was not altered by either procedure until temperatures high enough to produce injury were employed. In artificial fever, contrary to current belief, the circulation through the viscera as well as the peripheral tissues is definitely augmented.

References

1. Wolfson, Harold: Studies on Effect of Physical Therapeutic Procedures on Function and Structure, J. A. M. A. **96**:2019 (June) 1931.

2. Kissin, Milton and Bierman, William: Influence of Hyperpyrexia on Velocity of Blood Flow, Proc. Soc. Exper. Biol. & Med. **30**:527 (June) 1933.

3. Kopp, I.: The Velocity of the Blood Flow in Therapeutic Hyperpyrexia, Am. Heart J. **11**:475 (April) 1936.

4. Johnson, Carl A.; Osborne, Stafford and Scupham, George: Studies of Peripheral Vascular Phenomena, Am. J. Med. Sci. **190**:485 (Oct.) 1935.

5. Herrick, J. F.; Essex, Hiram E.; Mann, Frank C. and Baldes, Edward J.: The Effect of Digestion on the Blood Flow in Certain Blood Vessels of the Dog, Am. J. Physiol. **108**:621, 1934.

6. Bazett, H. C.: Temperature Changes and Their Effects on Circulation, Northwest Med. **32**:173 (May) 1933.

7. Drinker, C. K. and Field, M. E.: Lymphatics, Lymph and Tissue Fluid, William & Wilkins Co., Baltimore, 1933, p. 162.

8. Gesenius, H.: Ueber Tiefenhyperämie, zugleich ein Beitrag zur Wirkungsweise der Ultrakurzwellen, Deutsche med. Wchnschr. **62**:1533 (Sept. 18) 1936.

EXPERIMENTS WITH DECIMETER-WAVE THERAPY

MARTHA BRÜNNER-ORNSTEIN, M.D.

Head of the Department of Physical Therapy of the Neurological and Psychiatrical University Clinic

VIENNA, AUSTRIA

Our research with decimeter waves so far as they pertain to the treatment of tumors and their metastases with combined x-ray and decimeter wave irradiations is still in its incipiency. It is along the line investigated by Denier of France who uses a Magnetron generator of a wavelength of 80 centimetres, with which he obtained favorable therapeutic results when combined with x-rays.

Since such apparatus have not been manufactured until recently, we were obliged to rely upon our own resources, and constructed our own apparatus (figs. 1, 2) with the aid of Ingenieur Herzan and Dr. Randa, who unfortunately died a victim to his profession a few weeks ago.

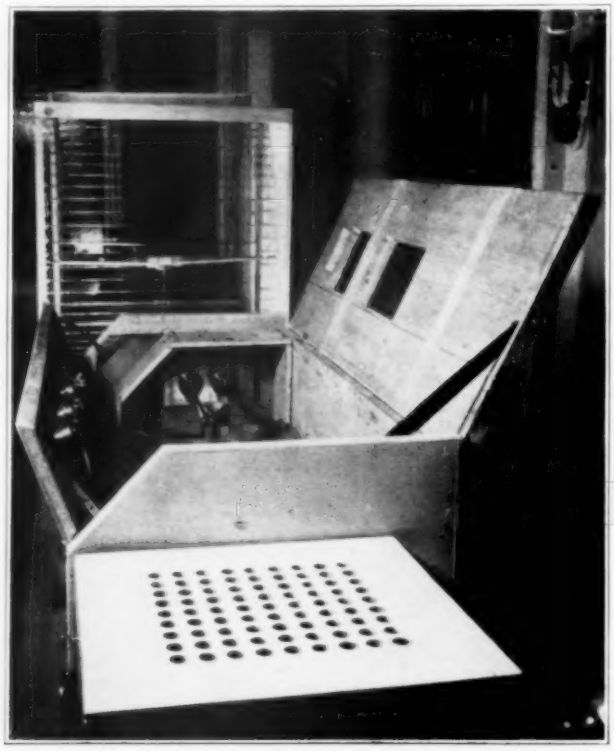

Fig. 1. — View of circuit in foreground, composed of Lecher system and special magnetron tube, which emits highest known wattage efficiency at 60 cm. waves. In background is the parabolic wire system that focuses the energy as illustrated on opposite page.

We used as a generator a so-called Magnetron tube, the waves of which have a length of 60 centimetres. The output is between 80 and 100 watts, which is remarkable considering the shortness of the wavelength.

The most essential feature of this apparatus is the manner of conveying the

electromagnetic energy to the patient. Two parallel cables (Lecher system) lead the high frequency energy from the anodes to a dipole which radiates the energy. This dipole is placed in the focus of a parabola represented by fine insulated copper wires spanned parallel in a wooden frame.

This parabola emits parallel waves which are reflected by an equal parabola placed opposite. Between these two parabolas, waves are produced, which can be shown by a receiving dipole whose metal parts are connected by a small electric lamp. This lamp lights up on the nodal points of the field and is extinguished at the points of low energy. The patient is placed between the two parabolas and in this way is exposed to a considerable influence commensurate with the output of the generator.

The condensations of energy in the field between the parabolas are sufficiently large so that they can be detected as heat sensation when the hand is placed in the field.

We have already made a report (Strahlentherapie, 1937, vol. 59) on our calorimetric measures in this field to the effect that the heating of the various tissues by decimeter waves is selective to certain tissues, the lungs showing the strongest heating. It is interesting to point out that the experiments of Schereschewsky showed similar results with longer waves.

With this apparatus we have treated a series of primary tumors and

Fig. 2. — Treatment in a parabolic wire arrangement which focuses the rays through the subject. Thermal sensation is practically nil, requiring explanation of biologic action upon other factors than heat.

metastases that have been refractory to x-ray treatment. We subject the tumors to an irradiation with decimeter waves for about 45 minutes. One hour later the x-ray treatment is administered.

The number of our cases is too small and the time of observation too

short; nevertheless we are in a position to state that carcinoma and metastases refractory to x-ray therapy have disappeared after our combined treatment. It is especially to be noted that the extreme pains caused by tumors or metastases are relieved to a large degree by this method. This can be explained by the fact that the size of the tumors is decreased, and also by the extreme soothing effect which we have observed in neurological cases, on which subject I have already spoken at the 1937 session of the International Fever Conference in New York.

Since tumors quite frequently cause pains by pressure on nerve trunks, the above mentioned soothing effect can be explained by the favorable influence of decimeter waves.

In order to find an explanation for the influence on tumors by the combined short wave and x-ray therapy I would like to point out the following possibility. It is known that short wave treatment on neoplastic tissue has generally unfavorable results, such as increased growth, due to stimulation of cell-division. On the other hand it is known that especially very young cells have little resistance to the action of x-rays. We believe that especially the increase of young cells by decimeter waves brings about better conditions for the action of the rays. The tumor which, through the influence of the decimeter waves is stimulated to growth, is especially in this stage more sensitive to the x-rays.

We have first treated radioresistent cases, because in this type the efficiency of a method is easily demonstrated. Recently we have begun to treat other tumors with the combined method. For an appreciation of improved therapeutic results with x-ray irradiations, it is necessary to compare large series of patients treated by x-rays alone and combined with the decimeter wave. At present we are not able to give a definite opinion on this matter, but I think it would be important enough to continue research along this line. Perhaps this short exposition will stimulate similar experiments in other countries as a means of combating malignant neoplastic disease.

Medical Association Offers to Hold Patents

Upsetting 23 years of policy, the American Medical Association has admitted indirectly that patents on medical discoveries are needed.

Dr. Morris Fishbein speaking before the American Chemical Society meeting at Rochester, N. Y., advocated the setting up of a non-profit holding corporation to administer patents in the medical and health fields.

The new suggestion of the powerful and conservative A.M.A. includes suitable royalties to the discoverers. This is a distinct change from the 1914 resolution of the A.M.A. which did not permit it to accept patents. Under this resolution neither the A.M.A. nor the patentees would receive remuneration for the patents.

In effect, the physicians now recognize that the profit motive in the development of research discoveries has an important function in present day American society.

Under its 1914 resolution the American Medical Association never accepted any medical patents and it did not formulate any plan for the administration and control of patents in the medical field.

The new proposal advanced by the A.M.A. spokesman is a modern compromise with the rigid principles of medical ethics which state distinctly "it is unprofessional to receive remuneration from patents for surgical instruments or medicines."

The new suggestion for the control of medical patents, declared Dr. Fishbein, seems needed because of the diversified methods which university and nonprofit research foundation laboratories have been compelled to take in order to protect their discoveries from unscrupulous commercial exploitation.

Dr. Fishbein cited the discovery, patenting and control of insulin, used in treating diabetes, as an example of desirable control of medical discovery. The arguments in the patent field over the production of vitamin D and vitamin D products are illustrative of the troubles that may arise, added Dr. Fishbein in contrast. He continued:

"The sun in the skin should be freely available to all who wish to use it. Yet it has been hinted that there are some concerned with patents on vitamin D who would even inhibit investigators from experimenting with the sun."—*Science News Letter.*

PHYSICAL THERAPY OF FIBROSITIS *

FRANK H. KRUSEN, M.D.

Section on Physical Therapy, The Mayo Clinic

ROCHESTER, MINNESOTA

A great mass of literature on fibrositis has appeared in Europe, and in England several books (one by Llewellyn and Jones[1] being 693 pages in length) have been written on this subject. As yet, little is to be found in the American literature. There seems to be, therefore, a definite need for better recognition of this condition in this country and a better understanding of its treatment.

Stockman[2] has defined fibrositis as "a condition of chronic inflammation of the white fibrous tissue of the fasciae, aponeuroses, sheaths of muscles and nerves, ligaments, tendons, periosteum, and subcutaneous tissue, occurring in all parts of the body, and giving rise to pain, aching, stiffness and other symptoms the result of preceding general infections, or of local inflammation or injuries." Practically all of the British writers on this subject have followed the original work of Stockman and anyone who reads his work can hardly fail to be convinced of the essential correctness of many of his observations. Hench[3] and his coworkers have defined fibrositis as "an inflammation of connective tissue" and have classified it anatomically in five forms: (1) panniculitis (fibrositis of subcutaneous tissue); (2) bursal or tenosynovial fibrositis; (3) fascial and intramuscular fibrositis; (4) periarticular fibrositis, and (5) perineural fibrositis. Slocumb,[4] who is one of the few American physicians who has written in detail concerning this subject, has stated: "Fibrositis may affect fibrous tissue anywhere in the body," and that "depending on what tissues are involved the resultant clinical symptoms may vary." From an etiologic standpoint fibrositis may be classified as follows: (1) inflammatory fibrositis (infectious, toxic or traumatic), (Telling[5]), and (2) degenerative (from aging of tissue), (Buckley[6]). Slocumb[7] said: "A tentative classification based on etiologic grounds might be: (1) Primary fibrositis independent of any other recognized disease due to infection or toxemia — nonspecific fibrositis. (2) Secondary (fibrositis) due to some known cause as trauma, gonorrhea, rheumatic fever, gout or influenza. The clinical and pathologic features are still incomplete." Assuming that these definitions and classifications are correct, it becomes apparent that fibrositis is a protean disease which may affect many regions of the human body. "When writers speak of 'fibrositis' they usually mean a primary form — disease of fibrous tissue independent of disease elsewhere."[3]

Pathologic Changes

Stockman,[2] in a description of the pathologic changes that occur in fibrositis remarked that the new fibrous tissue which is formed differs from normal fibrous tissue in its tendency to contract: "it can be massaged away," and it is swollen, painful and tender on pressure. Copeman[8] described the presence of nodules of fibrous tissue and said that this tissue differed from that found elsewhere in that it could be "rubbed away by means of skilled massage." Poynter and Schlesinger[9] also said that "painful palpable nodules can often be actually removed by massage, preferably in conjunction with heat." Likewise, Thomson and Gordon[10] pointed

* Read at the meeting of the Mid-Western and Southern Sections of the American Congress of Physical Therapy, St. Louis, Missouri, March 9, 1937.

out that the fibrous tissue formed as a result of the inflammatory reaction in fibrositis was "of a lower order than the normal fibrous tissue supporting the various organs." They said: "The morbid lesions in fibrositis take the form of 'nodules'," and that in treatment one of the essentials is "to find the nodule and 'rub it away'."

These descriptions by various British authors are extremely significant from the standpoint of treatment since they suggest that heavy massage in combination with manipulation, exercise and stretching may be of value in this condition. All writers on this subject describe nodules, indurations or fibrous thickenings which frequently can be palpated in the muscles or fasciae. Stockman indicated that these indurations might assume various forms, at times, as happens especially in the lumbar aponeuroses or fasciae latae, large regions may become thickened and occasionally more prominent and painful indurations may give the skin a hard, inelastic and slightly brawny feeling. He felt that more commonly the indurations were circumscribed and that they could be palpated as small swellings varying in size from that of a split pea to that of an almond, or exceptionally, reaching the size of a small nut. Frequently they take the form of thin strands or cords running through the fascia or the subcutaneous tissue. Both Stockman and Copeman said that they had excised many of these indurations and studied them histologically (fig. 1).

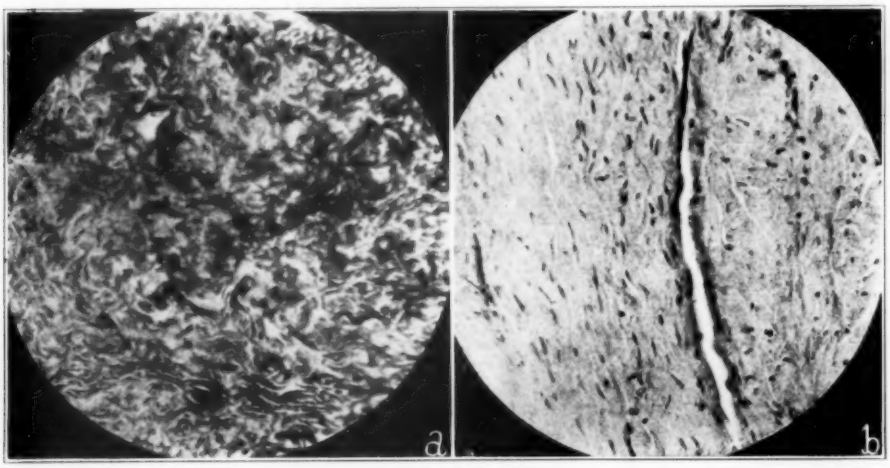

Fig. 1. — Histologic appearance of fibrositic nodules; *a*, early appearance; *b*, late appearance (From Stockman[2]).

Stockman expressed the belief that the indurations might be attributable to a chronic general infection with an organism of attenuated virulence and to irritation from its toxin, or that these local regions of fibrosis might be attributable to small colonies of microbes which invaded the tissues and caused a reaction that destroyed the invaders rather rapidly. He believed that these organisms were probably nonpyogenic; that is, that they did not attract the polymorphonuclear leukocytes and hence there was no softening of the tissues or formation of pus, but that instead there were left behind small patches of fibrous tissue which persisted and spread.

Copeman said that it had been suggested that the nodules and indurations found in this condition were comparable with those of acute rheumatic fever and therefore he placed fibrositis in the rheumatic cate-

gory. He said that several observers, including himself, had removed and sectioned these nodules and that the microscopic report was always that of low grade fibrous tissue with no characteristic arrangement. Copeman concluded, therefore, that these indurations appeared to represent "the monuments of past inflammatory skirmishes" in the local fibrous tissue and that they were not necessarily signs of present activity unless they were definitely situated in the affected region and were themselves acutely tender. He said that those nodules which were found in unaffected regions often would also be tender on pressure and that in such cases it was probable that a small sensory nerve ending had been caught in the contracting fibrous tissue.

Cyriax,[11] in discussing fibrositis of the neck, said that he felt it was not sufficiently appreciated that there were small, localized muscular contractions around many, if indeed not all, of the nodules of fibrositis. Wilson[12] believed that fibrositic nodules caused pain by the abnormal strain placed on the muscle fibers and that the nodules or indurations interfered with the function of the muscle fibers. He felt that this irritation evoked protective fixation of the adjacent part of the muscles and that the widespread pain was due to the stretching of this fixed portion of the muscle when certain movements were attempted. He also believed that the fibrotic nodules contained living microörganisms, presumably streptococci, as well as toxins. However, he offered no proof for this belief and to date there has been no evidence presented to show that organisms are present in such indurations.

Wilson[13] said that in fibrositis the morbid process is not restricted to one particular tissue but that it usually affects muscular structures, especially their fascial coverings, their aponeuroses, insertions, intermuscular septae, the fibrous capsules of joints, the nerve sheaths, bursae, fibrous ligaments and even the periosteum of the bones. She concluded that the essential pathologic change probably was an inflammatory hyperplasia of the fibrous tissue, the affected regions being swelled, indurated and tender to pressure, while sudden movements of the affected muscles caused intense pain. She quoted Dr. A. Muller as having described the changes in the muscular structures as follows: (1) hypertonicity, (2) induration in the muscle body and hardening of its fibrous sheath, (3) the definite formation of the typical nodule, and (4) swelling.

Hench and his colleagues said:

> The small or fairly large subcutaneous nodules frequently found in the sacro-iliac regions are regarded by many as evidence of fibrositis, active or old. They may be painless or painful depending on the stage of inflammation therein. Because they are often found in patients who give no history of fibrositis, some regard them as of no significance. Among 170 unselected hospital patients with various complaints Sutro found subcutaneous nodules generally over sacro-iliac joints or near the tips of the lumbar spinous processes, in ninety-four cases (unilateral in forty-five, bilateral in forty-nine). Thirty-three of the patients had low backache; ten had no nodules, and sixteen had tender and seven nontender nodules.

Sutro[14] examined nodules removed from four of these patients and demonstrated that they consisted of "lobules of adult fat of normal appearance without signs of recent or old inflammation or other evidence of metabolic or toxic disturbance." He concluded that they were "protective buffer-pads over poorly muscle-covered areas of sacrum and ilium" and that they were not a part of any recognized disease. It was pointed out by the reviewers (Hench, et al.[3]), that:

> This study represents a laudable beginning but does not settle the issue. The relief which two of the four patients obtained by removal of nodules is not explained,

nor is the tenderness of the nodules. Many more nodules in various stages of tenderness and formation should be examined, as well as sections of adjacent fibrous tissue. It is difficult to believe that such nodules are 'normal' even if they are often symptomless and in patients who give no history of fibrositis.

Clinical Diagnosis

In a number of clinics for the treatment of rheumatic diseases in Great Britain, from 20 to 55 per cent of all the patients are found to have fibrositis. While there the climate and geographic situation may have much to do with the high incidence of this condition, it would seem that American physicians, probably because of lack of familiarity, must be overlooking a considerable percentage of such cases. Careful palpation of all painful regions while the muscle is in a relaxed state will, I believe, tend to convince an observer of the frequent presence of painful nodules or induration in the soft tissues. Stockman has listed the chief symptoms of fibrositis as pain, aching, stiffness, a readiness to feel muscular fatigue, painful interference of muscular movements, and a chronic lack of energy and vigor. Copeman has expressed the opinion that in the diagnosis of fibrositis too much stress possibly has been placed on the detection of nodules. He said that it must be admitted that if unaffected regions were also examined the probability would be strong that similar nodules would be detected. He thought that these regions of active fibrosis could only be palpated in muscles which were in a state of relaxation and that with rough handling the patient would generally contract his muscles defensively and thus obscure the underlying pathologic changes.

Justina Wilson believed that hypertonicity could be found in any muscle that had become the seat of a fibrositis, because after contraction the affected muscles remained in a state of irritation, hypertension and even spasm. She felt that this condition gradually became more or less chronic and that by degrees "knotty deposits" were formed and could be palpated. She asserted that these deposits were definitely tender to pressure and that the morbid processes might extend to the sheaths of the nerves of the affected region and produce much pain which often might simulate a brachial perineuritis or sciatica. She contended that the specific nodule of fibrositis "could only be found on very deep palpation" and that such palpation is "an art in itself." She indicated that the favorite sites for these nodules are in the regions about the insertions of the muscles and that these indurations might vary in size from that of a pin point to that of a lentil, or they might even be much larger than a pea. Some nodules are round and others spindle shaped. To the experienced palpating fingers they present a distinct and specific hardness (fig. 2). She believed that the nodules become the center for hypertonicity and muscular irritation and that they are often very difficult to find because of this extreme hypertonicity or improper technic in palpation. Gentle palpation is often too slight and, on the other hand, a sudden sharp "digging" of fingers will often give rise to more muscular spasm which will further obscure the presence of induration. The correct method consists of skillful and gradual pressure, increased by degrees to a point at which the deeper structures may be palpated while the part remains relaxed. Justina Wilson felt that the swelling of the involved muscles is a prominent feature of the acute stage and that it also is present in chronic fibrositis, being especially apparent in the trapezius, deltoid, gluteal and gastrocnemius muscles, in which their whole volume appears to be increased. She concluded that these four changes, hypertonicity, induration, formation of typical nodules and swelling are almost constant in this disease and can usually be found if searched for carefully.

Slocumb[4] has pointed out that fibrositis is often wrongly diagnosed as

Fig. 2. — Fibrositis: Skin markings which delineate the approximate size and shape of the indurations palpated by the examiner.

atrophic arthritis or chronic nervous exhaustion. In some patients there are demonstrable inflammatory nodules in the fibrous tissue during attacks of fibrositis, and may later be absorbed or the exudate may become organized and result in fibrous scar tissue. These old scarred nodules may be painless on palpation while the actively inflamed portions may be felt as tender nodules or regions, the indurated regions in some cases being obscured by muscular spasm. Slocumb further asserted that the anatomic sites most frequently affected were the capsular, intramuscular, subcutaneous and perineural fibrous tissue, bursae and tendons; that at each attack one or more such sites might be affected, and that a history of previous attacks in different anatomic sites frequently could be obtained. In spite of discomfort, patients may continue to be very active; however, as a rule, fatigue and exhaustion become prominent symptoms.

Differential Diagnosis

Frequently pleurodynia or fibrositis of the thorax is diagnosed as angina pectoris. Fibrositis of the rectus abdominis or other muscles may produce vague abdominal pains, which may be thought to be due to a visceral lesion. According to Hench and his collaborators: "In abdominal fibrositis pain and tenderness are elicited by 'finger-tip pressure' rather than by 'flat-hand pressure'; tender spots are more or less localized, but may be multiple and occupy positions not usually affected by visceral disease; muscle rigidity (usually present in the latter) is absent, and pain may be intermittent and affected by weather."

These same authors said:

Perineural fibrositis generally affects brachial or sciatic nerves and is often called

'neuritis' a misnomer unfortunately sanctioned by physicians. In 'brachial perineuritis' there is tenderness over the brachial plexus above and below the clavicle and pain when the arm is abducted. Pain follows the distribution of nerves affected. . . . Gluteal fibrositis may be present with or without sciatic fibrositis, as may lumbar fibrositis (lumbago) also. Telling believed there were more cases of fibrositic 'trigeminal' neuralgia than of true trigeminal neuralgia.

The two commonest forms of fibrositis are the localized or diffuse intramuscular fibrositis ('myalgia,' 'neuromuscular pain,' 'muscular rheumatism'), and periarticular fibrositis ('arthralgia,' 'capsular rheumatism'). Wilcox and Hench emphasized the importance of differentiating the latter from 'arthritis' which it is usually erroneously called.

Slocumb[15] has pointed out that patients who have fibrositis usually appear in good physical condition, which is not so frequently the case in atrophic and hypertrophic arthritis. Furthermore, in fibrositis there is no intra-articular hydrops and no muscular atrophy such as is found in arthritis, although there may be slight thickening of the capsule of the joint. In fibrositis roentgenograms of the joints remain normal; the sedimentation rate of erythrocytes is normal or only slightly elevated. Also, in contrast to the average case of arthritis, there is usually no loss of weight and no significant anemia. Furthermore, on subsidence of the acute stage the function of the joints generally becomes normal although occasionally fibrous contractures occur.

Slocumb differentiated periarticular fibrositis and arthritis. He concluded that in any given case the differential diagnosis between periarticular fibrositis and atrophic arthritis is based on a survey of certain direct and indirect evidence for and against the presence of intra-articular disease. Direct evidence includes synovial hydrops and roentgenographic evidence of disease. Less direct evidence is afforded by the appearance of the joints; redness, tenderness, muscular atrophy and definite swelling speak in favor of arthritis as opposed to fibrositis which is exclusively extra-articular. Indirect evidence is afforded by a characteristic history and by laboratory data, particularly estimations of the sedimentation rate of the erythrocytes and estimation of the concentration of hemoglobin. The weight curve also is significant since patients who have true arthritis are much more likely to lose weight than are patients who have fibrositis. Slocumb concluded:

The differential diagnosis in favor of periarticular fibrositis is made on the persistence with which direct and indirect evidence of intra-articular disease remains absent. When objective changes, systemic manifestations and alterations in laboratory findings known to be relatively constant in cases of atrophic arthritis remain persistently absent the arthralgia, stiffness and articular thickening can be, with no little confidence, ascribed to periarticular fibrositis and the fear of impending arthritis can be laid aside.

Although Dawson[16] felt that the nodules and indurations found in the extra-articular forms of fibrositis could be distinguished from the nodules of rheumatoid arthritis because they were painful whereas in arthritis the nodules were rarely painful, I agree with Slocumb that the nodules in infectious arthritis and fibrositis are practically the same and that many of the nodules in fibrositis are not tender.

The common sites at which fibrositic nodules or indurations are palpable are in the lower lumbar or presacral region, in the back of the neck along the nuchal line, along the upper border of the trapezius muscle, and less frequently, in the scapular regions, intercostal muscles, deltoid or pectoral muscles, in the rectus abdominis muscles or in the gastrocnemius muscle (fig. 3). Nodules or indurations are rarely felt in the muscles of the thigh or forearm.

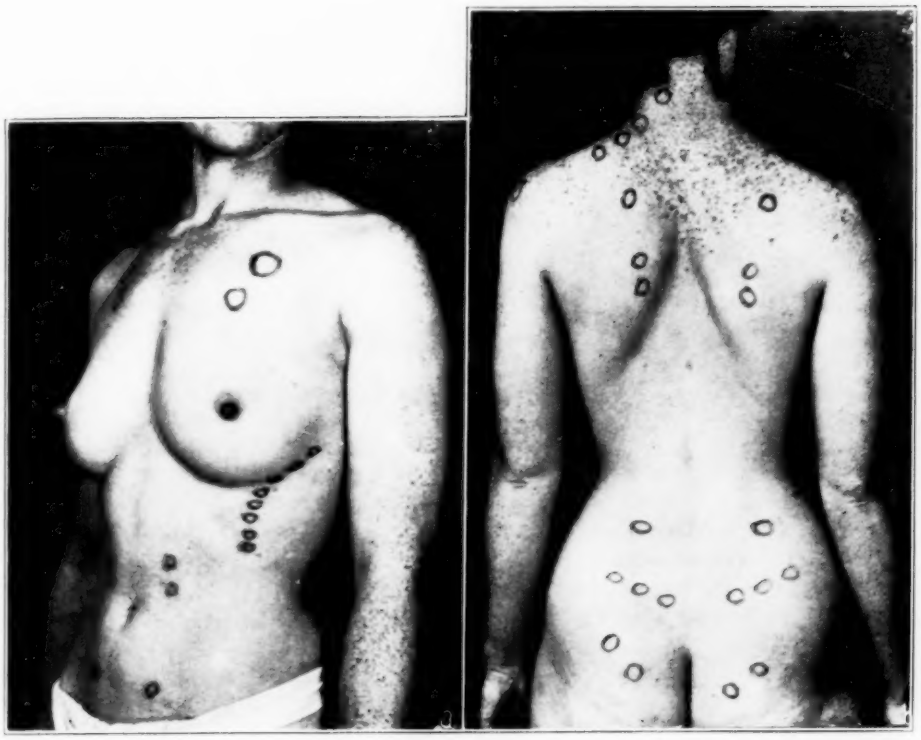

Fig. 3. — Showing the common sites for fibrositic induration; (*a*) on anterior portion of body; (*b*) on posterior portion of body.

Fibrositic Headache

It may be frequently noted that in association with the presence of fibrositic indurations in the posterior cervical region there is a chronic type of occipital headache. In this connection Copeman has said that the neck and occiput are extremely common sites of fibrositis, which often is described by the patient as headache. He felt that if, on further investigation, it is found that the pain is in the occipital region in the upper posterior portion of the neck, if definite spots of actual local tenderness are found, and if pressure on these spots intensifies the pain, one can be almost certain that fibrositic headache is the correct diagnosis. Telling considered fibrositic headache the most common type of chronic or intermittent headache. The four diagnostic features are "persistency, thickening, nape-of-the-neck location and tenderness."

Copeman pointed out that in order to ascertain the presence or absence of fibrositic nodules the patient should be instructed to rest his head forward on the thorax of the examining physician, thereby relaxing the muscles of the neck and facilitating examination. Copeman said that the indurations were usually to be found in the region of the occipital protuberance and that fibrositic headaches were generally worse after a night's rest. Cyriax has likewise discussed the presence of fibrositic headaches and urged their treatment by physical measures.

Treatment

In this country very little detailed information concerning the use of physical therapy in fibrositis has been presented. If mentioned at all, there is usually simply a notation that certain physical measures may be of value

but little or no definite information on exact methods of treatment is given. Such details are extremely important if physical therapy is to be of value in this condition.

For example, in a recent current article on fibrositis, Hunt[17] gave an excellent description of the etiology, pathology, symptoms and diagnosis, but devoted only a few lines to the use of the physical measures, which are considered so important by British writers and must be described in detail to be employed successfully.

The treatment of fibrositis as described by various continental writers is largely based on the clinical description of Stockman. The most interesting point is that practically all writers on this subject consider that the judicious application of heat, followed by a special type of deep local massage, seems almost specific. According to Stockman, the most effective local measure of all is effleurage, which should be instituted in the acute stage. Since the parts are tender at this time, the manipulations must be begun gently and applied in a manner to "get rid of the exudation and relieve tension." Gradually, much firmer pressure should be used, and, as a rule, the pain will be relieved "in a few days." He believed that as long as the fibrositic indurations remained, the patient was subject to similar attacks on every exposure to exciting causes. He felt that to obtain more or less permanent relief from muscular rheumatism the indurations must be dispersed by massage and that in all but the most recent cases this procedure was always tedious and more or less painful. The only means of accomplishing the desired result is to utilize massage and exercise. General massage is of no value and according to Thomson and Gordon "mere rubbing of the skin is of no use whatever." The massage must be specifically directed to any palpable thickenings and to painful regions, great care being taken not to be too severe at first. After a few days the congestion and exudation are eliminated and the fibrous thickenings consequently become more defined and many of them are only then detected. Stockman said that in about a fortnight the massage becomes much less painful and more pressure could then be exerted, the tips of the fingers or knuckles being used especially for manipulation of the nodules in conjunction with deep effleurage of the whole part. Massage should be applied daily, and ten to fifteen minutes should be devoted to each affected region. Applications of heat prior to the administration of massage render it less painful and more effective. Stockman pointed out that the length of treatment varies greatly and that recent soft thickenings were often dispersed within one to three weeks, a very usual time being four to eight weeks, but in some cases it was necessary to give several courses of treatment for this length of time. Some of the knots become hard and fibrous and persist. If a nodule or induration can be compressed against a bony part, more effective pressure can be exerted and the nodule is more rapidly removed than it is when it is deeply buried "among fleshy muscles." In the heel the thick integument makes efficient treatment almost impossible. The treatment of fibrous indurations around joints is conducted on the same principles, that is, heavy massage is applied in conjunction with passive and active movements of the joints. Exercises should be such as are best calculated to stretch the muscles and other structures involved. These exercises can easily be carried out without apparatus.

Most writers on this subject believe that the nodules or indurations can be actually broken up and dispersed by heavy local massage. Thus, Justina Wilson said that the treatment of fibrositis consists in the application of heat and special massage of the infiltrated regions in conjunction with passive movements and active exercise. She recommended that radiant heat from a carbon filament lamp or infra-red lamp or deep heat from a diather-

my machine should be applied to the affected region and that following this there should be applied a special form of massage "consisting of gliding of a practiced, strong, yet sympathetic hand over the skin in circular movements with very gradual penetration at first almost without the patient's knowledge, and later, if he be sensible, with full coöperation, gradually getting beneath the subcutaneous fat into the depth of the muscle which must be completely relaxed." When the nodule is finally palpated the movements become more penetrative and purposeful. They are, in reality, circular movements over the whole indurated area and are given with strong hyperextended fingers, one hand reinforcing the other and working very slowly in concentric circles. The operator must avoid flexion of the elbows, which weakens the efforts and exhausts the strength. Such a procedure is definitely less trying to the patient than sudden clawing movements with one "brutal" thumb. It is impossible to use such manipulation without producing some pain; the pain, however, can be minimized if the friction movements are skillful and gradual and if they are followed by deep stroking to promote resorption. The breaking up of nodules by massage is mentioned, and it is suggested that a very essential part of the treatment is active movement which should be begun after one or two treatments have been given and after the pain has been somewhat relieved. These movements must be carried out faithfully and the fullest possible range must be attempted each time. The treatment must not be left to the patient's discretion, because with few exceptions, patients display "the energy of a snail" and "loathe and bitterly resent any self-effort." Very few patients suffering from fibrositis ever fully extend their arms above their heads or really hyperextend and thoroughly stretch the muscles of the neck and back during the course of the day. Wilson pointed out that fibrositis about the elbow joint was comparatively rare since this joint was not only flexed often but extended frequently in all the small doings of life and, in addition, it has a very good blood supply. She concluded: "I have yet to meet the patient who says that the time spent and the pain endured have been in vain."

Stacey Wilson[12] said that the object of manipulative treatment must be to burst the nodule by sudden and very forcible pressure of the finger tips, which is calculated to tear apart the agglutinated fibers. He recommended that this be accomplished by a rapid to-and-fro rolling movement with pressure, and said that the treatment could be adopted successfully only in situations in which the cord or nodule could be compressed against subjacent bone, and also where there were no structures such as nerves or tendon sheaths which might be damaged by the force used. He recommended that when fibrotic nodules occurred in the center of a muscle the rolling pressure be applied at either end of the nodule, "gradually breaking it down and rolling the free fibers against one another at the point where they became agglutinated and thus separate them from the mass and lessen its size."

Stacey Wilson believed that it might take twenty or thirty minutes of massage, first at one pole and then at the other, to "break down" such a nodule, but that when it was done the result might be "most dramatic." He said that a sensation of grating under the finger tips usually preceded the final dispersion of a fibrotic core. As soon as the nodule was broken down, the need for protective fixation ceased and the muscle regained its normal mobility. He even recommended the use of a properly shaped and padded piece of wood to localize the blow from a light wooden mallet over the thickened cords. He felt that in cases of severe fibrositis in which these indurations were very hard they could be broken up with slight pain to the patient by means of a sharp blow. He suggested that the mallet should be made of light wood, should have a head measuring about 3 inches in

diameter, and be so balanced as to give a sharp, light blow. He felt that if too many nodules were broken down at one sitting a definite reaction might result, as it does when vaccine treatment is used, and that such a reaction might occur within twenty-four to forty-eight hours and last for two days. He recommended that an interval of seven days be allowed to lapse between these severe treatments, and felt that pain, apart from any constitutional reaction, was a frequent result of treatment. It is probable that massage alone will usually suffice in the treatment of fibrositis and that recourse to the use of a mallet will seldom be necessary.

Mennell,[18] in his textbook on massage, quoted Radcliffe, who said that ordinary massage had little or no effect on the induration of fibrositis and that a rather large number of his patients had been treated by hydrotherapy and massage of the ordinary type for weeks or months without satisfactory results. Ordinary massage which was applied over the whole limb or limbs without concentration on the affected region was useless. After treatment for three or four weeks with hydrotherapy and localized massage which consisted of deep thumbing movements over the affected regions, followed by deep kneading and upward pressure, the deposits, which could actually be felt to break up, disappeared and muscular pain vanished. Mennell commented that he could only add to Radcliffe's statement that the friction should be applied very gently and as tolerance increased it might be increased steadily. He felt that the presence of nodular thickenings could sometimes be detected more easily if a lubricant was applied to the patient's skin, but that its use was a definite hindrance rather than an assistance during massage.

Cyriax likewise said that massage should be applied so that the fingers of the operator and the skin over the part to be treated were moving as one over the underlying muscles, and that it should not be applied so that the fingers glided over the skin, since the penetrating effect was greatly increased by the former method.

Summary

At The Mayo Clinic, as a result of the coöperation of Hench and Slocumb, who call our attention to the nodules of fibrositis when they are found, all of our physical therapy technicians have become thoroughly conscious of these nodules, bands or indurations. I have been amazed at the frequency with which such indurations have been discovered in the subcutaneous tissues and muscles of patients receiving massage. Although in many instances these nodules are acutely tender and the indurations produce spasm of the muscles in which they are situated, in approximately 50 per cent of the cases there is no tenderness and the muscles apparently have adjusted themselves to the presence of the fibrotic mass and are not spastic. It is probable, that, as Copeman has said, too much attention has been paid to the nodules which are so frequently observed in these cases. It should be emphasized that non-nodular portions of painful muscles may also need treatment. In the Third Rheumatism Review,[3] it was noted that "Some writers make much of the nodules of fibrositis which to others seem 'only accessible to the finger of faith.' Because some consider it difficult to locate nodules or to demonstrate pathologic changes in tissues removed at biopsy, fibrositis has been defined as a 'disease which physicians found but surgeons rarely find'." It seems safe to conclude that unless many continental observers are mistaken there is a form of "muscular rheumatism" commonly called "fibrositis" which is characterized by the formation of fibrous nodules, bands or indurated regions which are acutely tender at first and associated with muscle spasm, and that later, if the condition becomes chronic, the

tenderness and muscle spasm tend to disappear. Furthermore, the continental observers have said that such indurations may be broken up and "massaged away" by a special type of heavy stroking and kneading massage which is applied directly to the indurations and produces subsequent relief. It is necessary to inform the patient of the nature of the condition and of the fact that the treatment will at first cause him more pain in order that he may understand what is being attempted and may coöperate.

In the Section on Physical Therapy at the clinic, our rather limited observations have progressed from a point of skepticism to one at which we are convinced of the frequent presence of palpable tender nodules, bands, indurations, or simply painful regions[19] which appear occasionally to disappear as a result of the special type of heavy massage described previously. Furthermore, it would seem that massage often causes disappearance of pain, tenderness and stiffness. One is still led to wonder whether these nodules are as important as many writers believe and whether they can be "rubbed away" as consistently as some state. Apparently fibrositis is frequently overlooked and the value of a special type of massage in treatment has often been unrecognized. It may also be concluded that the diagnosis of "fibrositis," if not carefully made, may become a "catch-all" for a group of symptoms. Our British colleagues are undoubtedly "fibrositis" overenthusiasts, for which they are partly to blame. We, in America, are equally culpable for overlooking the group of cases in which a distinct clinical entity known as "fibrositis" may be determined by careful diagnostic methods.

Cecil[20] has pointed out: "The disease spoken of as fibrositis is much in need of a more substantial pathological background." Nevertheless, there seems to be sufficient clinical evidence available to warrant much greater consideration of the value of physical therapy in this condition.

It seems apparent that certain forms of physical therapy are of distinct value in controlling the attacks of fibrositis. Recurrences are frequently seen and it will often be necessary to use other methods of treatment sometimes in conjunction with continued physical therapy in order to combat them.

References

1. Llewellyn, L. J., and Jones, A. B.: Fibrositis (Gouty, Infective, Traumatic); So-called Chronic Rheumatism, Including Villous Synovitis of Knee and Hip, and Sacro-iliac Relaxation, New York, Rebman Company, 1915, p. 693.

2. Stockman, Ralph: Rheumatism and Arthritis, Edinburgh, W. Green & Son, Ltd., 1920, p. 132.

3. Hench, P. S.; Bauer, Walter; Fletcher, A. A.; Ghrist, David; Hall, Francis, and White, T. P.: Problem of Rheumatism and Arthritis, Review American and English Literature for 1935, Ann. Int. Med. **10**:754 (Dec.) 1936.

4. Slocumb, C. H.: Atrophic and Hypertrophic Arthritis and Fibrositis, Arch. Phys. Therap., X-Ray, Rad. **17**:571 (Sept.) 1936.

5. Telling, W. H. M.: Clinical Importance of Fibrositis in General Practice, Brit. M. J. **1**:689 (April 6) 1935.

6. Buckley, C. W.: Fibrositis, Lumbago and Sciatica, Practitioner **134**:129 (Feb.) 1935.

7. Slocumb, C. H.: Differential Diagnosis of Periarticular Fibrositis and Arthritis, J. A. M. A. **107**:534-535 (Aug. 15) 1936.

8. Copeman, W. S. C.: The Treatment of Rheumatism in General Practice, Baltimore, William Wood & Company, 1933, p. 215.

9. Poynter, F. J., and Schlesinger, Bernard: Recent Advances in Study of Rheumatism, Philadelphia, P. Blakiston's Son & Company, 1931, p. 313.

10. Thomson, F. G., and Gordon, R. G.: Chronic Rheumatic Diseases: Their Diagnosis and Treatment, Edinburgh, Oxford University Press, 1926, p. 202.

11. Cyriax, E.: On Fibrositis of Neck, Brit. J. Phys. Med. **10**:49 (July) 1935.

12. Wilson, T. S.: Manipulative Treatment of Subacute and Chronic Fibrositis Brit. M. J. **1**:298 (Feb. 15) 1936.

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TERMINOLOGY RELATING TO MEDICAL HYPERTHERMIA

A. BESSEMANS, M.D.

Director of the Institute of Hygiene and Bacteriology of the State University

GHENT, BELGIUM

The Latin word "febris" and the Greek word "puretos" mean "fever." Moreover, the Latin word "calor" (meaning originally "heat") as well as the Greek words "thermè" (originally "heat") and "pur" (originally "fire") have been used to designate fever as well as heat, the "fire," accompanying it.

Springing from this etymology, the biological and medical literature has incorporated certain words with a definite meaning, such as febrigenic, facient, febrifuge, apyretic and apyrexia, antipyretic and antipyrexia, calorie, calorigenic, calorimetry, hyperthemia, thermogenic, and the like. But certain other words, especially with regard to artificial production of heat in living tissues, have caused regrettable misconceptions.

With the object of exchanging views which would tend toward simplifying and unifying the terminology, we suggest that all the words in which one or the other of the roots "febr" and "pyr" occur should apply only to "general" tissue heat (the same meaning "fever" being generally attributed to these two roots).

This being established, "fever," "pyrexia" and "general hyperthemia" would be synonymous, irrespective whether a natural or artificial, spontaneous or incited condition is implied. The word "hyperpyrexia," having become superfluous, could then be abandoned. It would be obviously necessary to distinguish "local hyperthemia," but the term "local pyrexia" as well as "local fever" would be a misnomer.

Depending on whether the action is preventive or therapeutic, the following terms would be used: General thermoprophylaxis (pyretoprophylaxis) and local thermoprophylaxis; or general thermotherapy (pyretotherapy) and local thermotherapy. Doubtless, instead of "pyretoprophylaxis" and "pyretotherapy," one could say "febriprophylaxis" and "febritherapy," but these last appellations might, more than the first named, be taken to mean prophylaxis and therapy *of* fever. For this reason we suggest that they be rejected.

Finally, different prefixes indicate either the agent employed to produce hyperthemia (aero-, hydro-, paraffi-, electro-), or the thermogenic process: Balneo- (balneation), radio- (radiation), actino- (light radiation), dia- (deep radiation).

For example radiothermy, which could be general (radiopyrexia) or local, would be subdivided in: Infrared, luminous (general actinothermy, or actinopyrexia and local actinothermy), electric (general electrothermy or electropyrexia and local electrothermy).

In the same way, electrothermy would include general electrodiathermy (or electropyrexia) and local electrodiathermy; to which would correspond the abbreviations of general diathermy (or diapyrexia) and local diathermy.

One would simply have to specify whether average, short, or ultrashort waves are used, or electromagnetic induction (general inductothermy or inductopyrexia).

PHYSICAL ASPECTS OF INFRARED RADIANT ENERGY IN THERAPY

WILLIAM T. ANDERSON, JR., Ph.D.

NEWARK, N. J.

One convenient form in which heat has been applied in therapy is by infrared radiations. These radiations occupy the invisible portion of the electromagnetic spectrum adjacent to the visible red, and, like the radiations in the visible spectrum, produce an increase in the temperature of any medium by which they are absorbed. In this respect they are dissimilar to the ultraviolet radiations, which are likewise invisible to the eye, but which are mainly chemical and fluorescent in their reactivity.

Irradiation with infrared energy has in particular been favored as a means for the application of heat to the skin and near-skin areas. It is a safe means for applying such heat, and is available from inexpensive equipment.

The sun is the natural source for infrared radiant energy, but is utilized only in certain sanatoria where time and convenience are not factors. Instead of sunlight, it is customary to generate infrared radiations in especially designed lamps known as "Infrared" or "Heat" lamps, and to obtain by electrical means controlled quantities of these radiations.

The physician making use of infrared radiation should be familiar with the laws which govern the production and utilization of radiation in order to obtain the maximum benefits from this energy source. Many have an adequate knowledge of radiation and apply this agency in a manner most helpful to their patients. However, judging from statements, published and unpublished, there exists another group of interested practitioners who largely depend upon "imaginative" knowledge of the subject, and who unwittingly remodel the laws which govern radiations to fit their own conceptions. It is with a desire to assist this latter group that this brief exposition on the physical aspects of the problem is submitted.

Physical Characteristics

The production of infrared radiations is normally associated with a "hot body," which is defined as being any substance at a higher temperature than the surrounding medium. The primary requirement for the emission of radiations is a difference in temperature. It matters not whether the difference in temperature has resulted from a source of heat generated or supplied from within the body, or whether the body has been warmed by the absorption of radiation received from another heated body.

The mathematicians have expressed this principle in the formula: $R = c\ (T^4 - t^4)$, where R = radiation per square centimeter of surface from a body at an absolute temperature T, to a second body at an absolute temperature t. "Absolute temperature," frequently referred to as degrees Kelvin, = Centigrade + 273, in which "c" is a constant and numerically equal to 5.75×10^{-12} watts per square centimeter.

It has been experimentally demonstrated that strictly this law can apply only to a "black" body. A "black" body is one with zero reflection. The blackest black known is spermwhale oil black, which reflects about 2 per cent. It is therefore obvious that all substances which may be used for infrared generators deviate considerably from the theoretical "black" body, and will therefore radiate less than application of the formula would indicate.

It follows that a body which is a good absorber is a good radiator, and that one which is a good reflector, or is transparent, is a poor radiator. A typical example is the steam radiator used for house heating, which when painted black is about 25 per cent more efficient than when painted with the usual aluminum finish.

It has been mentioned that the quantity of radiation per square centimeter of radiating surface is approximately dependent upon the temperature of the radiator. This quantity increases rapidly as the temperature of the radiator rises. It can also be seen that another means for increasing the total quantity of radiation is available, and that this can be accomplished without alteration of the temperature. This comprises an increase in the radiating area; namely, an increase in the number of square centimeters of surface. Thus it becomes possible to have two radiators which emit equal total quantities of radiation, but which are dissimilar as to temperature and area of the emitting surface. If there existed no losses by reflection, convection, and other causes, a radiator of tungsten with a surface area of 6.6 sq. cm. and at a temperature of 2970 degrees K (Kelvin or absolute temperature) would emit radiation equal in total quantity to that from iron with a surface area of 50 sq. cm. and at a temperature of 1000 degrees K.

It is generally known that infrared radiations, in a manner similar to the visible and ultraviolet radiations, may be grouped together to form a spectrum representing a large number of various wavelengths at relatively different energy contents. The area of a radiator does not affect its spectral emission. The temperature of a radiator does define its spectral emission. If a tungsten and an iron radiator at temperatures of 2970 and 1000 degrees K, respectively, are operated under conditions which give equal total radiation emission, and if the spectral energy distribution, i.e., the amount of radiant energy at each wavelength, is determined, the plotted results will resemble those shown in figure 1.

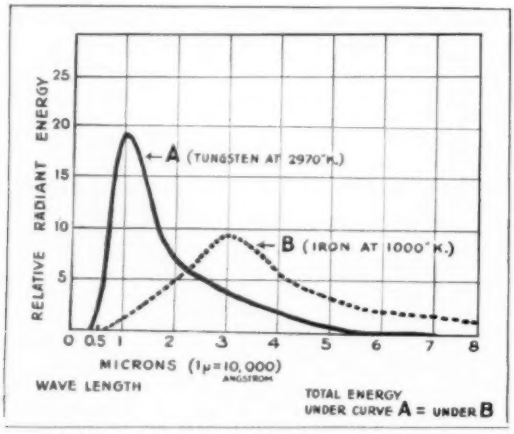

Fig. 1. — Equal energy curves illustrating differences in radiant energy distribution with wavelength for two bodies at two different temperatures.

In figure 1, curve A represents the radiation emission from the tungsten incandescent lamp (clear glass bulb) in which the filament is at a temperature of 2970 degrees K. Curve B represents the radiation emission from a cherry red iron resistor at a temperature of 1000 degrees Kelvin. The relative energy emitted is plotted against wavelength in microns. One micron = 0.001 millimeter = 10,000 Angstrom units. In the visible spectrum, radiations at about 0.8 micron appear deep red to the eye. The iron is at a

cherry red heat, and its emission begins at about 0.65 micron in the visible. The tungsten lamp emits radiations throughout the visible spectrum, and even in the blue and violet. Actually about 5 per cent of the total radiation energy from the tungsten is in the visible spectrum, while only about 0.1 per cent of the total energy from the heated iron is in the visible red. The total energy under curve A equals the total energy under curve B.

Further examination of these two curves shows that most of the radiant energy from the tungsten is located within the wavelength limits of 0.7 and 2.0 microns, and that from the iron lies within the limits 1.2 and 4.5 microns. The peak for the tungsten is much higher and steeper than that for the iron, although the total energy represented by the area under each curve has been arbitrarily taken as equal.

These observations have been the basis of another radiation law; namely, that radiators do not emit all wavelengths at equal and like intensities, and that the wavelength of maximum intensity shifts towards the visible and ultraviolet ends of the spectrum as the temperature of the radiator increases. For a "black" body the energy emitted at the wavelength of maximum intensity equals the absolute temperature of the radiator raised to the fifth power multiplied by a constant.

Infrared as Function of Temperature

These rules of radiation indicate that the temperature of the radiator may serve as a means for controlling the kind of infrared radiation applied in therapy. If a predominance of the longer wavelength is desired, the low temperature red-glowing resistor type element should be employed. If the treatment requires the near-visible radiations, the incandescent filament type lamp should be the one of choice.

The radiation characteristics of incandescent tungsten and glowing iron are typical of high and low temperature radiators. Another radiator, which frequently has found favor with the medical profession, is the carbon filament lamp. In this lamp the filament temperature is about 2150 degrees K. As would be expected, its radiation characteristics resemble somewhat more those of the tungsten lamp than they do those of the iron resistor at 1000 degrees K. If its spectral energy distribution were plotted in the manner of figure 1, it would be found that much of its emission energy was within the wavelength limits of 0.9 and 3.0 microns.

Other factors in the selection and use of infrared lamps are reflectors, glass bulbs, colored glass screens, wire protection screens, convection and conduction losses.

Analysis of Generators

The tungsten and carbon lamps are used with clear glass and red glass bulbs. With the clear glass bulb not all the radiant energy generated in the filament is emitted. Glasses do not transmit 100 per cent. Under the most favorable conditions, there is a reflection loss amounting to about 8 per cent. The thin glass absorbs an additional 3 per cent. This latter energy serves to warm the bulb, which then itself radiates, acting as a very low temperature radiator.

When red glass is used it must be a true ruby, and not just painted glass. This provides radiations primarily within the wavelength limits 0.7 and 2 microns. The heated bulb itself radiates in the very long wavelength infrared. A red glass bulb does not produce more infrared than a clear bulb operated at the same electrical input; the contrary is true. But it does provide a satisfactory source for those who object to visible light glare.

The visible light from incandescent filament lamps is in color appear-

ance more reddish than the light from sunshine. It has therefore been the practice to provide bulbs with a somewhat bluish glass which absorbs some of the red end of the spectrum in order to correct for the overabundance of red radiation from the filament. These blue colored glass bulbs may absorb as much as 30 per cent of the radiant energy in the red and near-infrared portion of the spectrum.

Resistor bars, iron heaters, glow radiators, and the like, which are not protected from air drafts by glass enclosures, dissipate some of their energy by convection and conduction. Hence they never attain the theoretical temperatures predicted by their electrical resistances and the electric current input. The radiant energy from them is always below that obtainable under ideal conditions. When they are protected by glass screens or mantels, they emit more nearly the theoretical quantities of radiation, but energy losses at the glass must be considered. Even when the glass absorbs some of the energy and re-radiates it, heat is lost by convection air currents, which cool the glass, and prevent it from radiating at its maximum temperature.

Wire mesh screens may be a necessary requirement for exposed heated elements, but they absorb considerable radiation, amounting in some instances to 25 or 30 per cent of the total. There seems to be no legitimate reason for their use when incandescent bulb or completely enclosed elements are employed.

The use of reflectors for radiations is very common. Their forms and structure are problems of engineering, and need not particularly concern the user of infrared equipment.

With the previously discussed radiation characteristics in mind, the physician is ready to consider what happens to radiation from the two typical infrared sources, the tungsten filament lamp and the iron resistor, when it falls upon the skin surface of the patient. This subject is not new, for a number of investigators have studied the penetration and absorption of infrared radiations by skin tissues. The most comprehensive research appears to have been performed by Paul[1] at the University of Heidelberg. Others who have contributed to the subject are Sonne,[2] at the Finsen Institute, Cartwright[3] at California Institute of Technology, Bierman,[4] in New York.

Some results obtained by the author and which are in general agreement with published data are indicated in figure 2, which illustrates a vertical cross section of the skin of a white adult. The strata comprising the skin structure are shown. The dimensions given represent average values. The stratum corneum and the stratum lucidum together have a thickness of about 0.5 millimeter. The stratum granulosum, stratum mucosum and the stratum germinativum comprise an additional 0.5 millimeter. The corium includes about one millimeter. Below it are fat and muscle.

It was already mentioned that all substances reflect radiations to some extent. White, untanned skin reflects very uniformly throughout the visible and infrared spectrum. Measurements made by procedures similar to those employed by Brunsting and Sheard[5] indicate that this reflection is of the order of 34 per cent of the incident radiation. The reflection is the same for both the radiation from the tungsten and that from the iron. The remaining 66 per cent radiation enters the skin, and is absorbed and converted into heat in the dermal layers.

Reference again to Figure 2 indicates in what proportions this radiation is absorbed in the different skin strata. Within the first 0.5 millimeter, comprising the stratum corneum and stratum lucidum, 20 per cent of the radiation from the tungsten and 59 per cent from the iron are absorbed and converted into heat. It would therefore appear that the glowing iron resistor

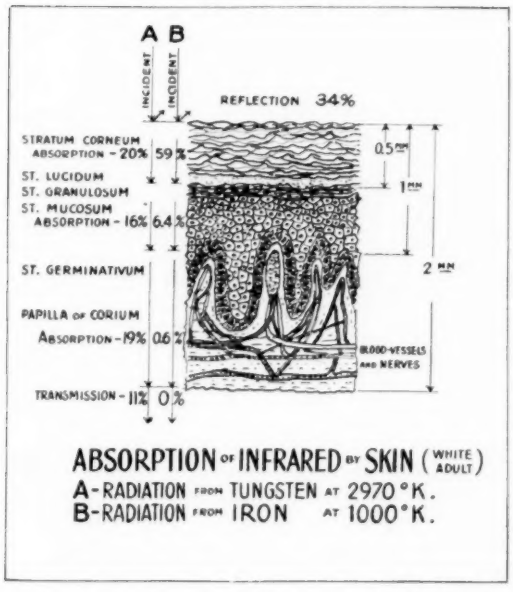

Fig. 2. — Per cent differential absorption by skin of infrared radiant energy from two radiators with characteristics of temperature and radiation distribution as illustrated in figure 1.

would be the element of choice when it is desirable to produce heating effects in these two strata of the skin.

Forty-six per cent of the radiation from the tungsten and 7 per cent of the radiant energy from the iron enter the stratum granulosum. About 16 per cent radiation from the tungsten and 6 per cent from the iron remain in the stratum granulosum, stratum mucosum and stratum germinativum and are converted into heat. The radiation from the tungsten appears to be more efficient for heating this part of the skin.

Thirty per cent of the radiant energy from the tungsten and 0.6 per cent of the energy from the iron resistor penetrate more than one millimeter of skin, and enter the corium. The skin shows selective absorption. Radiations penetrating a depth greater than one millimeter are in wavelength approximately 1 micron. Nineteen per cent of the radiant energy from the tungsten and the 0.6 per cent of the energy from the iron are absorbed and converted into heat in the corium. These radiations can produce heat effects upon the blood vessels, nerves, and the papillae located in the corium. The radiation from the tungsten appears to be an overwhelming choice if heat is to be produced in this region of the skin.

Eleven per cent of the radiation from the tungsten and zero per cent from the iron passes into the layer of muscle and fat. These are the radiations which penetrate more than 2 millimeters. It will be noted that no measureable quantity of radiation is received in the fat and muscle layers from the iron resistor. It has been reported (Cartwright) that some radiation from the tungsten is detectable even at a depth of 10 millimeters. A high temperature source with a maximum emission at or near 1 micron appears to be the choice, if heating effects are to be produced in the muscle and fat layers. Tungsten fulfills this requirement.

It is not the purpose of this paper to do more than to present the physical facts, and to point to possible conclusions based upon these facts. The results indicate that one can vary the spectral characteristics of his infrared lamp. He can select a generator which operates at relatively low tem-

peratures, and obtain therefrom mostly infra-red of long wavelength which will be absorbed primarily in the stratum corneum and stratum lucidum of the skin. He can select a high temperature generator, such as the tungsten filament lamp, and obtain thereby a predominance of near-visible infra-red, which penetrates deeply through the skin layers and even into the muscles and fat. He can compromise by selecting a generator which is neither low temperature nor high temperature. Such a generator would be the carbon filament lamp. The radiations from this lamp would give him less heating effect in the stratum corneum than would those from an iron resistor, but more than resulting from the absorbed radiations from a tungsten filament. The radiation absorbed in the corium would be similar to that from the tungsten, but less radiation would penetrate to the muscle. Thus it can be seen that the physician has means at his command for controlling the type of energy to meet the physiological needs of his patient.

References

1. Pauli W. E.: Ueber künstlich vergrösserte Durchlässigkeit der tierischen und menschlichen Haut für den longwelligen Teil des Spektrums, Strahlentherapie **25**: 543 (March) 1927.

2. Sonne, Carl: Investigation on Action of Luminous Rays and Their Mode of Action, Arch. Phys. Therap., X-Ray, Rad. **10**:93 (March); 239 (July) 1929.

3. Cartwright, C. Hawley: Infra-red Transmission of Flesh, J. Opt. Soc., Am. **20**:81 (Feb.) 1930.

4. Bierman, William: Effects of Photothermal Radiations Upon Cutaneous and Subcutaneous Temperatures, Arch. Phys. Therap., X-Ray, Rad. **14**:717 (Dec.) 1933.

5. Brunsting, Louis A., and Sheard, Charles: Modification of Spectrophotometer for Obtaining Measurements on Reflection of Light from Living Materials, J. Opt. Soc., Am. **18**:349 (April) 1929.

PHYSICAL MEASURES IN TRAUMATIC AND FUNCTIONAL NEUROSES *

NATHAN H. POLMER, M.D.

From the Departments of Physical Therapy, Touro Infirmary and the Graduate School of Medicine

NEW ORLEANS

Modern life with its complexity of problems, its ever changing panorama of new situations to face has taxed our bio-physiological make-up. While it is true that with a better understanding of physiology and improved methods of examination the diagnosis of neurasthenia is made less frequently than in former days, yet there is an increasing number of post-traumatic neuroses in industrial medicine presenting a problem of first magnitude.

Traumatic neurosis is difficult to define. Neuhaus refers to it as a "psychogenic, non-structural nervous disease following soon after physical injury." It is the modern counterpart of "railroad spine," "shell-shock" and similar conditions. Such a terminology conveys the idea that the neurosis and the ensuing symptoms are the direct result of the occasion which preceded these particular symptoms — *post hoc ergo propter hoc.* Such a conception has the serious objection of lending a dignity to the disease, pre-

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senting difficulty in its treatment and in explaining the true state of affairs to the patient. "Neurosis after injury" is perhaps a better term to use.

Etiologic Factors

In most cases we do not know the exact motivating causes of these manifestations, but it is safe to state that physical violence and mental stress from external causes are only contributory factors. Altshuler has pointed out that traumatic neurosis is found more frequently in unskilled laborers and among individuals with limited intellect who are vocationally maladjusted. According to this author the individual who develops traumatic neurosis is rarely vocationally adjusted. He supports himself by receiving money for labor but "does not work," for work implies not only physical but also emotional application. Having had the opportunity to treat with physical measures athletic injuries for a number of years, I have yet to see a case of traumatic neurosis in this type of patient. On the other hand in the group of patients referred for physical therapy by industrial surgeons, I have not infrequently encountered neuroses associated with trauma.

On the principle of a dominating causative factor, Fetterman has proposed the following types of classification:

1. Injury — due to physical damage from brain and cord trauma.
2. Industrial — due to human difficulties or physical dangers at work.
3. Indemnity — due to a drive for compensation.
4. Inherent — due to pre-existing or potential neurosis.

Traumatic neuroses have a fairly definite symptomatology and clinically present three kinds of manifestations:

1. Anxiety state. The chief symptoms are, anxiety and a sense of apprehension, restlessness, irritability, rapid pulse and emotional instability.
2. Neurasthenic state. This is characterized by subjective symptoms, lack of interest and initiative with marked weakness.
3. Hysterical state. The varied motor and sensory manifestations of hysteria dominate the picture.

Treatment

The treatment of psychoneuroses after injury is a baffling problem, and physical therapy departments are frequently confronted with these trying cases. At the outset it is important to distinguish malingering from the traumatic neuroses, including hysteria. Malingering has been defined as the deliberate feigning, induction or protraction of illness with the object of personal gain. It differs from neurosis which is not considered to be deliberate, though it does protract illness. The hysterical patient has the background of stigmata from birth; the neurasthenic that of nervous instability, while the malingerer just a plain faker. True malingering is rare, and the diagnosis is usually made by exclusion, and sometimes by actually catching the individual in a lie. I have seen one patient with persistent edema of the foot and ankle, induced by a constrictor around the leg. Two similar cases have been reported to me by a colleague. Cases in which the malingerer has been trapped have been rather infrequent. The movie camera is a valuable aid in detecting the malingerer and recording his actions and movements. The following is an illustrative case:

F. R., a longshoreman, had a prolonged disability after a back sprain in which the physical and x-ray findings were negative. On examination, patient held his back muscles rigid, all spinal motions were guarded and apparently limited and painful. So bizarre were his actions that motion pictures were made of his undressing for and dressing after treatment. He used the inverted handle of a walking cane to put on and remove his trousers. He was given a careful examination including anterior, posterior and lateral views of the lumbar spine and sacroiliac regions. Infra-

red followed by faradic stimulation to the spinal and lumbosacral muscles was applied. Marked reactions were obtained. The patient even felt the electricity when an electrode not connected to the apparatus was applied to the skin while the faradic coil was vibrating. After the treatment the patient was told to return to the office of the physician who referred him for examination. Unknown to the patient I followed him in his thirty-seven block walk and every several blocks obtained pictures of him walking with a natural gait, swinging the cane on which he had just come limping to me. Toward the end of the promenade the patient saw a face to face movie being taken of him. He immediately reported to the doctor who was treating him and said, "I don't want to go any more to that doctor uptown who gives electric treatments. I'd rather go back to work." This patient realizing that the game was up, discharged himself.

It occasionally becomes the physician's unpleasant duty to show up malingerers. Moorehead has rightfully stated this class of patients "always make me mad, because they apparently place so low an estimate on a doctor's diagnostic ability."

Another case will demonstrate the therapeutic results obtained by physical measures in a case of traumatic neurosis associated with some degree of malingering.

I. M., age 23, a laborer, was referred to me on July 11, 1935. He stated that while unloading bananas on the 4th of July, 1935, he was bitten by a spider in the flexor surface of the right arm just above the elbow. He complained of pain and stiffness in the fingers and wrist. The fingers were markedly contracted in flexion and attempts to straighten them met with decided resistance by the patient. There was no difference in the circumference of the upper extremities, although the patient stated that his whole right arm was swelled. On being asked to strip to the waist, he persistently refused to do so and stated that he was unable to use his right hand. He took the shirt off with his left hand and used his teeth for grasping, but as he slid the undershirt over the right shoulder the camera recorded the patient quickly raising the right upper extremity to get the undershirt off. In my report to the doctor who referred him I wrote: "I gave the patient infra-red radiation to the entire upper extremity and followed this by interrupted faradic stimulation to all the muscles, but, with particular emphasis on the extensor muscles of the wrist and fingers and, as if by magic, the fingers straightened out after this treatment, and all movements of the wrist, elbow and shoulder could be easily, readily and voluntarily accomplished throughout their full range of motion. As this was an interesting case I made motion pictures, before and after treatment, for my records. This represents a case of hysterical paralysis with some degree of malingering and the prognosis, I believe, is good. In fact, this patient has been cured."

Not all cases of stiff and painful joints after injury are due to malingering or neurosis, but the latter may develop or be superimposed upon an actual pathologic process, particularly if the surgical results of injury are not properly and adequately treated.

S. A., a laborer, fell 15 feet through a hole in a platform while walking to work on the river front. He was taken in an ambulance to a charity hospital where x-rays of the back and the usual pictures of the foot and ankle were reported negative. He was given hot soaks and encouraged to be up and about the ward. The progress notes recorded that the patient was unable to bear weight, had some edema and complained of pain. Thirty-six days after admission an x-ray of the heel in the postero-anterior position showed an old fracture of the left os calcis which was impacted in fairly good position. A cast was then applied and the patient was discharged to the fracture clinic. Subsequently he was referred to me as a public liability case, who presented symptoms of an anxiety neurosis. He was afraid that he would be a hopeless cripple for life. Physical therapy treatment consisting of hot whirlpool baths, sinusoidal stimulation to the leg and calf muscles, massage and exercise gave a good measure of functional restoration which, however, was greatly augmented by a lump sum settlement. This case illustrates how legal factors, compensation problems and litigation frequently complicate the picture.

On the other hand traumatic neuroses can and frequently do simulate organic disease. Hammond states, "When the history does not ring true, when the complaints do not tally with the superficial findings we doubt the

claims." When in doubt the conscientious physician will use all means at his command to determine the facts. In many of these cases electrodiagnosis at once forcefully and quickly reveals the true state of affairs. Afterwards electrical muscle stimulation is used with sufficient intensity to convince the patient that functional restoration has resulted. A motion picture record of the previously "paralyzed" part going through its full range of motion helps in fixing the cure. Cases of this type who have had protracted disability have returned to work after one to several physical treatments.

L. T., age 22, was referred from another city to an industrial surgeon for suture of the extensor tendons of the fourth and fifth fingers. He had a flexion contracture of six months duration. He was sent to me for electrodiagnosis. Faradic stimulation gave good flexion and extension responses. Five daily treatments resulted in functional restoration.

F. P. was referred from a country town for examination and treatment for a possible old cervical fracture or shoulder injury. He had a prolonged disability after contusion of the neck and shoulder. The neck muscles were held rigid and voluntary motion was limited in all directions and very painful. Abduction of the arm was painful and limited to 45 degrees. There was atrophy of the disuse in the shoulder girdle. X-ray examination of the cervical spine and shoulder proved negative. The patient was placed supine on the treatment table. Under infra-red radiation the muscle spasm in the neck relaxed. Following electrical muscle stimulation the patient was able to use his shoulder throughout the normal range of motion. After several treatments he was discharged and returned to his home fit for duty.

Brilliant results are likewise obtained in most cases of hysterical paralysis, particularly those of fairly recent origin. Here again, after having listened to the patient's story and given him the benefit of a careful examination, quick intensive methods of treatment combined with psychotherapy at the proper time give the patient a start toward rapid recovery. I have found the use of motor point charts helpful in "explaining away the paralysis" during electrical muscle stimulation. We first demonstrate the action of the galvanic or faradic current on the unaffected side, and then, by explaining to the patient exactly what to expect when stimulation is applied at a given point "if the nerve has not been permanently damaged by injury or disease," we place him in a mood to relinquish his symptoms and expect recovery.

C. L. a laborer, age 41, was brought to the hospital July 1, 1935, after being struck in the lumbar region by a swinging derrick on board a ship. He complained of excruciating pain in the lumbar region and was unable to use his lower extremities. Physical and X-ray examinations were negative for fracture or bone injury. The muscle tone was good, the reflexes normal and there were no signs pointing to a cord injury. Yet the patient could not move his legs and was unable to turn over in bed without assistance. Thus he rested for eleven days, enjoying full diet and hospital care until July 11th, at which time faradic stimulation was applied at the muscles of the back and lower extremities. He was able to get out of bed and walk after the first treatment, and was discharged from the hospital after the third treatment.

Many case histories could be presented describing functional paralysis both after physical trauma and unrelated to external violence in which physical therapy combined with reassurance and a certain measure of psychotherapy resulted in functional restitution of the affected parts. We have had beneficial results in three cases of hysterical aphonia, a case of hysterical deafness, two cases of functional blindness, a case of functional loss of smell and taste, and a case of psychogenic retention of urine. While we do not pose as a faith healer, psychogenic involvement of all parts and organs have been restored to function after physical therapy. No claim is made that this treatment is physiologically indicated, but it certainly is therapeutically effective. To expect a patient of this type to get well without treament is to have him admit that his symptoms are unreal. Psychologically administered physical

(*Concluded on page 718*)

TREATMENT OF BIRTH INJURIES AND RELATED PROBLEMS *

EARL R. CARLSON, M.D.

NEW YORK

It has been variously reported that from 15 to 20 per cent of the crippled children in the United States are victims of intracranial hemorrhage. It is also stated that two-thirds of such cases are mentally defective. Unless there has been an injury to the cortical cells so gross as to cause idiocy, the birth injured may be considered essentially as an individual who has little or no voluntary control over his reflexes. As the injury is generally a diffuse one we seldom find a pure type of dyskinesia. There is a large amount of nervous energy spent in attempts to move a single muscle group and often the mere thought of moving a finger is sufficient to throw the entire body musculature into a chaos of writhing movements. As long as the factors of fear, self-consciousness and anxiety are in abeyance the patient may have difficulty in making a normal coordinated movement. After a study of over 3,000 cases of congenital motor handicaps, it is my impression that two-thirds of them are not mentally defective. Serious behavior difficulties arise largely because the patient has not been taught to adjust himself to his handicap and the conditions of life as he finds them.

While considerable optimism in many cases of the birth injured is justified, we must remember that we are never going to make a normal individual out of him any more than we can of the man with an amputated arm. Mentally, to be sure, he may far excel the ability of the latter, but unless he has learned to cope with the shortcomings which the absence of an arm imposes he is never going to become a happy individual. In a similar manner we cannot expect one whose nervous system has a low threshold of irritability as a result of birth injury to become as efficient as a normal individual. Again, we may find a mentality which exceeds the normal, but unless such a person has learned the limitations which such a hyperactive nervous system imposes on him and has been taught to cope with his shortcomings he is not going to be happy. The solution of the problem of the birth injured is therefore far from being one solely of muscle training. Nothing is more pathetic than a child with a spastic arm or leg approaching adolescence who in spite of having had the best muscle training is rapidly becoming markedly introspective because of his inability to adjust himself to his handicap. In some instances the milder the physical affliction the more severe is the mental handicap. Fear and shyness exert an inhibitory influence on motor activity, and with the birth injured there is a constant conflict between the desire to correlate the movements and the inhibitory emotion. While it is true that the persistent conflict can be explained on an organic basis the patient is always the subject of more profound psychologic difficulties. The afflicted frequently uses his handicap as a defense mechanism for the contemplation of reality. In school the teachers are lenient with him because should he not know the answer to a question, it does not take much effort to appear more nervous than usual and thus invariably is not pressed like other pupils. If such a situation is not combated with proper discipline in early life a personality difficult of self-adjustment is bound to develop.

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The mother, who ties up the good hand of the hemiplegic child in the hopes that the more he uses the maimed member the sooner he will get well, is doing the child no more good than the mother who expects her normal infant to walk sooner through exercise given before the nervous system is sufficiently developed. Stepping movements show themselves almost immediately at birth, but no amount of exercises is going to enable the normal infant to walk until his nervous system has obtained sufficient development. Serious behavior problems as well as speech defects are likely to arise in children who are forced to use the paralyzed limbs beyond the limits circumscribed by anatomic growth and physiologic response. The sooner we realize that physical therapy in the case of the congenital motor handicapped can be effective only if the exercises are made commensurate to the limits imposed by anatomic and physiologic conditions, the sooner we are going to make useful citizens out of them.

When the hand is difficult to control, an appreciable delay in the mental development can be accounted for by the lack in that process of mental growth which proceeds by grasp and touch in every normal child. Physical therapy in the form of muscle training can do much to help the child to control the hand but such measures should be regarded as an aid rather than as the only means through which mental growth can be obtained. If a child never obtains complete control of its hand it does not necessarily mean that it is going to be an idiot.

Cases are on record of individuals born with muscular handicapped arms who hold professional positions. A birth injured girl who cannot walk or feed herself becomes an author of books which do not reflect her handicap. A man with a severe motor difficulty and speech defect who was illiterate at twenty earns B.A., M.A., and Ph.D. degrees at forty, and becomes a successful bibliographer of neuropsychiatric literature. Another spastic with a speech defect intelligible only to his friends earns a law degree and becomes so efficient in legal literature that he directs several attorneys how to defend his cases. Other examples could be mentioned of successful physicians, teachers, librarians and business men who have congenital difficulties.

When the nervous system is damaged by disease or injury, growth can not make amends but the nervous system seems to develop to an optimum in the unimpaired areas. At the same time as the unimpaired areas of the brain develop there is less tension to interfere with normal coordinated muscular movements. This is illustrated in the case of a chemistry student with congenital motor difficulties. He could hardly feed himself when he entered college. Through studying chemistry he developed considerable manual dexterity. When he started laboratory work fear of acid burns made him spill solutions although he had no difficulty in handling two empty beakers. As he learned to direct his attention from his hands to the chemistry problem, fear abated and manual control increased. When the idea occurred to him that he was able to use his hands in a normal way when he concentrated on something other than manual activity, he learned a lesson that meant more to his physical progress than any amount of conscious muscle training he had ever undergone.

The majority of patients with congenital motor difficulties improve not so much from a daily routine of exercises as they do from activities which are more objective in purpose. This is illustrated in the case of a girl who came to the Neurological Institute for treatment. She was so handicapped that she could not feed herself, nevertheless she was able to play the piano very satisfactorily. Feeding was so much a matter of routine that she could not get her mind off her muscles, whereas playing the piano enabled her

to forget herself in her music with a consequent increase in normal facilities.

In this connection it is interesting to mention the case of an ex-Red Sox baseball player who was suffering from encephalitis. He had so much muscular rigidity that he could hardly walk or feed himself, but when a ball was thrown toward him, he caught it almost as gracefully as any professional player. It seemed that the encephalitis had obliterated the motion pattern for instinctive habits, such as walking and the use of his hands, while the pattern for the acquired acts had not been lost.

In the case of the birth injured, I feel that when the patterns for instinctive acts such as walking and other activities have through injury or disease been lost, there are potentials for the acquisition of skilled acts in the unimpaired areas of the brain which can be developed much the same as when a normal person acquires manipulative dexterity. The trouble has been that in getting the unimpaired areas of the brain to function to an optimum we have forgotten that training must not be merely a daily dozen but rather stimulation of an objective character, much as when a person learns to play the piano. The pianist is not interested in muscle training per se but acquires manual dexterity as he loses himself in his music.

If Helen Keller, deprived as she was of sight, hearing, taste and smell with only one-fifth of her brain areas accessible to satisfactory contacts with the world could make an adjustment to life equal to the average of such adjustments, there is no reason why the congenital motor handicapped of average intelligence who has so many more channels of expression open to him than Helen Keller, should not at least obtain an equal place in life.

For physical therapy to be effective in the treatment of children with congenital motor difficulties, it must be given in conjunction with an academic program where the two can proceed simultaneously with a minimum amount of distraction from a daily routine. The patient should be made to understand that his aim in life is not merely to live to get well but rather to live for an objective purpose. Perhaps this explains why one person with an almost insurmountable motor handicap becomes a physician, lawyer, librarian or a successful business man, while another spastic who had only a slight affliction and an average intelligence to begin with becomes antisocial in spite of having had the best of physical training.

Neurologic Institute.

Bibliography

1. Carlson, Earl R.: Infantile Cerebral Palsy: Its Treatment by Selective Inhibition of Sensory Stimuli, Ann. Int. Med. 11:324 (Aug.) 1937.

2. Gesell, Arnold: Infancy and Human Growth, New York, Macmillan & Co., 1928, pp. 228-224.

THE SPASTIC CHILD *

FRANK H. EWERHARDT, M.D.

ST. LOUIS, MISSOURI

In this discussion of spastic paralysis from the standpoint of physical therapy it is not my intention to dwell on pathologic findings, but rather to point out the commoner symptoms that are amenable to non-surgical treatment. Some of the known causes for spastic paralysis are intracranial hemorrhages in the new born, encephalitis, and meningitis. Spastic paralysis is present at or appears soon after birth and tends to improve as the child grows older. The spastic child does not sit, talk or walk at the normal age, and shows backward tendencies particularly in its studies. Some spastic patients may be bright and quick in certain fields and retarded in others, while occasionally a child may be normally alert and intelligent.

The muscular plight of the spastic child is extremely difficult as the spasticity is increased by any attempt to use the limbs, although it is decreased in the relaxation of sleep. The reflexes are usually exaggerated, accompanied by a positive Babinski sign, and the extremities may be in a state of constant movement. In the condition of general muscular spasticity where voluntary control is lost, the more powerful muscle groups overcome their weaker antagonists and draw the limbs into a position of deformity which prevents walking. Such a child presents a picture of muscular imbalance, and may develop a typical "scissors gait."

It is apparent that if certain areas of the brain are damaged, the muscles supplied by nerves coming from these areas will not function properly. More impulses than is normal are going to one group of muscles producing much more powerful contractions than the antagonistic group, thereby causing a muscle imbalance. A common example is the over-stimulated hamstring groups flexing the knee and the gastrocnemius muscles pulling the foot into a tip-toe position.

The extent of the brain lesion determines the degree to which the limbs and muscles of the body may be involved. Muscles and joints supplied by the damaged area lose their relation and synchronization to other parts of the body and perform independently in an erratic fashion. The rigid groups do not relax when the antagonistic groups begin to work; therefore the child finds great difficulty in executing any motor activity. This muscular imbalance causes rapid fatigue of the strained muscles.

The field of surgery has been explored with a view of bringing about a correction of actual deformities and decreasing spasticity. Muscle transplantations, tenotomies, plastic lengthening of tendons and neurectomies have been performed without pronounced success. Tenotomy of the adductor muscles of the thigh and neurectomy of the obturator nerve for overactive adductors and scissor's gait are familiar procedures. The beneficial effects following any operative method are largely dependent upon the factor of intelligence, or the ability of the child to use with advantage the results gained with the removal of structural factors which in the first instance hindered proper coordinated movements. Medicinal treatment, including the administration of glandular products, such as pituitary and thyroid extracts, is of value only in relieving the child of any additional physical burden.

The treatment of the spastic child is principally a problem of re-education. As the destroyed brain cells do not have the power of regeneration, their function is lost and it remains for other portions of the brain to assume the duties

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of the lost areas. The normal child develops mentally as it acquires motor skill; therefore the spastic child may often be underrated mentally, as it is handicapped in expressing in a motor way its sensory ideas. The improvement of its physical disability through surgery and training explains why so many of these children seem to gain in intelligence.

All training and treatment of a spastic child should be under the supervision of a competent neurologist and an orthopedic surgeon. The technician who undertakes the training of a spastic child must have the conviction that with constant work and patience the child may be able eventually to handle itself with expedience. The child must be imbued with this hope, so that it will develop a helpful attitude and exert its best efforts to attain this goal.

Rehabilitation

If the spastic child is to be fully benefited we must take advantage of all available methods for its rehabilitation. These include the use of bracing, as well as surgery. Bracing has a very definite place in the stretching of contractures and also in holding the joint steady, thus decreasing the number of vicarious moves and enabling the child to focus its attention on establishing a better balance while learning to walk. The braces should be discarded at the earliest possible moment to prevent the child from becoming too dependent upon them. Also to be emphasized is the very important role that corrective shoes play in gaining better foot mechanics.

In the examination and study of numerous spastic patients we have found that many of their problems could have been solved at an earlier time had proper occupational and physical therapy been instituted. Not to be overlooked in the rehabilitation process is the fact that with the cooperation of an alert and competent psychologist the potentiality of the occupational and physical therapy training may be greatly increased, with the end results surpassing ordinary expectations.

If the spastic child does not undergo treatment and training from the earliest possible time, but is brought in at a later age, the family as a rule has become so accustomed to pampering the individual that reconditioning is extremely difficult if not impossible.

Since during the pre-school age occupational and physical therapy can at best be only a part of the day's program, it seems wise to instruct the mother how to train the child. The technician or physician in charge may instruct the mother in the proper exercises or treatment which can and should be carried on at home. The education of the parent cannot be too strongly stressed where the child is receiving treatment and attending a special public school. The mother especially must exert herself to make the child independent within the home and give it every opportunity to utilize in many practical ways the control it has gained through care and training, rather than shielding it by inculcating an attitude of dependence upon her.

Special exercises for coordination and relaxation have an important place in the treatment of the spastic child. The duty of the technician is to teach the child how to exercise and then to induce it to perform these exercises with only occasional supervision. A supplementary list of specific exercises, adaptable to home use after preliminary instruction by the technician, is appended to this paper.

It should be realized that the parent plays a primary part in the success of the rehabilitation program. Physical and occupational therapy are necessary adjuncts, but the mother must carry on the job intelligently, firmly resolved against coddling or yielding to the child.

Relaxation

The technician undertaking the treatment of a spastic child must begin with the establishment of a basic principle which we designate as the "doctrine of relaxation." When the spastic child enters upon muscle and gait training, half the battle is won if the technician can induce relaxation, as herein lies the secret of training the extremities toward better coordination and function. The technician must exercise constant ingenuity, resourcefulness and patience to teach the patient to do simple, automatic things without becoming tense and excited. "Trying hard" for a spastic child simply slows up or prevents action and induces apparent muscular tremors. It must be taught to do unconstrainedly and slowly those things which it can do and be led on at an easy progression to the performance of more difficult or complicated acts. In the early stages of treatment rhythm plays an important part in reducing tension, and the patient relaxes appreciably when a certain pattern is established, e. g. by counting or repeating the movement over and over. In this way the child may be taught to inhibit those muscles not required and to use in a deliberate fashion those normally needed for a special act. As the term "relaxation" probably has no meaning to the child, the technician may suggest such descriptive word pictures as "feel heavy," "feel loose," "let yourself go." When it learns to lie relaxed the next step is to teach it to sit in a relaxed position. Have the patient sit squarely with arms straight, hands resting on thighs, the legs slightly apart to overcome the strong adductor muscles, and the feet flat on the floor.

Not to be overlooked in the establishment of relaxation are the beneficial effects of exercises in a warm pool. Water gymnastics are an excellent method of procedure, and as the warm water relaxes the muscles the factor of buoyancy aids in the process of exercising.

As contractures are the outstanding muscular defect, we must first stretch these shortened groups before we can attain any great degree of success in coordination and motor skill. This stretching of the muscles is done in our physical therapy department with an apparatus constructed to produce repeated rhythmic stretching movements, speed and tension being regulated at will. The fact that it is a mechanical device, each movement being exactly as the preceding one and following each other at a very definite rhythm, results, in our judgment, in a mental reaction favoring relaxation. I am aware of the Liddell-Sherrington stretch reflex theory (myotatic reflex) which concludes that the reaction of a muscle to passive stretching is an active reflex contraction. However, these authors conclude that this same active reflex contraction may be inhibited. At this time I can but give my own observations in this matter which are that with appropriate mechanical means, a spastic muscle may be stretched without eliciting the so-called stretch reflex contraction. Since the adductors, flexors and internal rotators are usually affected, we employ exercises which will give the child greater degrees of abduction and external rotation of the thigh, extension of the knees, and dorsiflexion of the feet in the lower extremities; and abducation and outward rotation of the shoulder, extension of the elbow and wrist, and extension of the fingers in the upper extremities.

Passive and Active Exercises

In the various stages of physical therapy of the spastic child, passive, active and resistive exercises are used to achieve the desired end. A passive exercise is one in which the movement is performed by an external agency and is not participated in by the patient. It is best to have the first exercises done passively by the technician, as any effort on the part of the patient at the early stage immediately throws the extremities into incoordinated movements.

An active exercise is a voluntary, purposeful movement initiated and per-

formed by the child itself. It is useful because of its very definite action on the neuro-muscular apparatus. Muscle coordination can only be brought about by using the brain-cord-muscle unit, and by repeated, purposeful movements initiated and executed by the patient.

A resistive exercise is one in which a movement is executed by the patient and resisted by the technician, or performed by the technician and resisted by the patient. Its value lies in the physiologic fact that during the action of the protagonist group of muscles inhibited impulses are directed to the antagonist group, thus tending towards lessened activity of that group.

After the child has attained relaxation and some degree of muscle control the next step is to have it stand. The patient should stand supported with feet slightly apart, knowing that it will have the aid of the technician, thus enabling it to relax somewhat and to feel more self-assured. The child should not look down at its feet and should try to let its arms hang easily at the side. The technician should withdraw his assistance very gradually so that the child will have the feeling of cooperation during the first attempts. Later it must be encouraged to maintain its balance and when able to stand alone it should try to take a step or two. Spastic children have a tendency to lift their feet high in the air and walk with the foot in the equinus position. A special effort should be made to place each foot squarely on the floor, to walk slowly, deliberately and without haste.

At this point active exercises to induce rhythm may be introduced to help establish a better balance. If the child can be taught to do a simple balance step by holding on to a stall bar, then later without holding for short periods, it will find the beginning steps less fearsome. Have the patient hold on to a stall bar, or similar support, and describe a circle with each foot in turn to slow rhythmical counting. Even humming slowly will cause the child to make more deliberate movements and prevent hurrying through the exercises, as generally it tries to go at top speed. Rhythm takes an increasingly important place in the training of spastic patients and should not be disregarded by operators in an endeavor to establish balance.

Besides relaxation, physical therapy also strives to teach coordination of mind and body. Through certain selected exercises the child acquires skill and grace in performing definite movements with hands and feet. The child must be taught to think the movement out first and then voluntarily to relax the tight muscle group and to contract the opposite group. At first it will do this with all the force it can exert, but with training it can teach itself to limit the power to just enough to accomplish the desired movement with ease. This is not a simple task and requires great perseverence on the part of both the technician and the patient. Repeated efforts should in time be rewarded by the child's ability to perform successfully intricate movements with the feet and skilled acts with the hands.

Special Training

Although speech training is not in the province of the average physical therapy or occupational therapy technician, it has such a definite relationship to general bodily muscular coordination that it seems proper to discuss it briefly.

Vocal training is an all important factor in helping the child, as speech defects are apt to cause it to become introverted and to develop pecularities of personality. Speech defects also isolate the child from the society of others, which greatly retards its progress. Those trained in speech work can cite many instances of marked improvement in school work and high increase in intelligence rating after overcoming speech difficulties. Dull normal persons have become normal, and potential morons have become dull normal persons after vocal training.

Speech training will show better results if undertaken after the child has attained some degree of control over the body and has made some progress in coordinating the extremities. It is a very slow process and requires patience and persistence as well as great skill. Some improvement in speech often follows after the child has had beneficial results through training in other departments.

Muscles of the throat should have special relaxing exercises, beginning with gentle massage of the neck, shoulder, and facial muscles and proceeding from this passive type of exercise to specific active exercises by the child itself. The child must not be allowed to read aloud until such time as it is able to enunciate in an understandable manner. A progressive list of exercises for vocal training in detail is included in the appended list.

The prognosis in regard to spastic paralysis should be guarded, as restoration of function is dependent upon so many factors — proper treatment, a careful program of re-education, cooperation between the home, school, and physician, and the extent of the central lesion. Gradual improvement, however, may be expected in all but the unusually severe cases; and normal function may sometimes be secured by proper treatment in milder cases, while even the more severe cases, and those with marked mental deficiency, may be benefited in proportion to the extent of the pathologic process.

Parents finding themselves faced with the responsibility of rearing a spastic child must resign themselves to this difficult task by adjusting their lives to that of the child. If they strive to meet the situation with patience and calm they will derive more happiness than by endeavoring to find an easy escape, or taking refuge in false hopes. Only in this way can they render the valuable aid of which the child is so sorely in need. The parents must guard against over-indulgence of the child, and while exercising a helpful attitude, should try to establish a spirit of independence in their charge. To avoid future unhappiness the parents should early seek the guidance of a competent orthopedic surgeon. Under his tutelage they can then, starting in the pre-school period, encourage the child by easy steps to new ventures, while at the same time allaying its fears. It is very difficult for the spastic patient to orient himself to his environment and the problem of acquiring poise and confidence is very similar to that of individuals in overcoming stage fright. The mother may do her part in the early encouragement of confidence by carrying out at home the instructions of the technician.

In order to develop within the child as it grows older a desire to be part of the scheme of things, it is well to place it in a group of handicapped children with the same intelligence level. Here it can meet other individuals on an equal footing and can learn to compete, thereby developing a feeling of personal worth and belief in itself instead of one of hopelessness and failure which comes if placed with a group of normal children of its age, where the patient is usually regarded as backward or stupid because of speech difficulties and lack of muscular coordination. If the child is not going to be self-supporting, and most of these children are not, it can learn to adjust itself to associated groups. The following figures taken from a school for crippled children show that of 700 that were graduated from the school 200 have been spastic patients, and were graduated from the 8th grades. Only a small percentage of these were partially self-supporting, and none entirely so. It is but fair to point out that in the regular school system there are probably a higher percentage of spastic pupils who do become self-supporting. At best, however, there are very few who can take their place side by side with, or who can do better than the untrained but normally healthy individual. We feel that many of the schools give the children, or allow them to develop ambitions far beyond their ability to attain, and where they are not going to be able to earn their own living we feel that they fail to

help them develop occupations which would make them happy, home-bound persons after school is over.

The parents should try to direct into other channels the child's overflow of accumulated energy which interferes with muscular control. Occupational therapy is important in furnishing a direction and use for this energy. If it is not possible to place a patient in a good school the parents may arrange for study and play with a group of similarly handicapped children, thus utilizing the time in which the child might otherwise sit and watch the activities of normal children, which would tend to morbid introversion and day dreaming.

We repeat, if possible the child should be placed in a proper school for here it will make the necessary adjustments which will enable it to fit more satisfactorily into adult life. Such a school will do everything to take advantage of the work being done under the guidance of the surgeon and technician. Here mental and physical development will progress together, and in company with others the spastic child will be spared the effects of unfair competition and consciousness of shortcomings so devastating to a child's character and personality.

If the child has a fair mentality with average or a little less than the average intelligence quotient (I. Q.) much can be done with the proper vocational and scholastic training within the mental and physical scope of the growing individual to enable him to become partially self-supporting to the extent of sustaining himself industrially where this is necessary.

With proper training and a careful program of rehabilitation, the latent natural ability of an averge intelligent spastic child may be developed to the point of excelling the ability of some average citizens, and certainly of those who have neglected to use advantageously the abilities which nature and opportunity have provided.

Suggested Exercises in the Treatment of Spastic Paralysis

Exercises helpful in acquiring coordination: (Some of the best of these exercises are done with the aid of a Swedish stall bar.)

1. Have the patient slowly climb up and down the stall bar. This engages both the hands and feet at the same time, thus coordinating both extremities.

2. From simple climbing up and down may be evolved more intricate exercises as climbing across from the lower right to the upper left corner.

3. Another method of climbing would be to try to skip every other bar.

4. If the patient has enough power in his hands he can hang by them and perform exercises with the legs.

5. By holding on to the stall bar the patient may do various foot placing exercises. This is excellent in the backward placing of the foot as it is hard for the patient to move his foot in that direction.

6. Have various colored tags hung on different bars and ask the child to point to them in turn as the colors are called out.

7. Have the child try to kick a ball suspended by a string.

Exercises for the lower extremities: 1. Patient lies on back in relaxed position. Roll thighs away from each other and hold as many counts as possible.

2. Same position: Hold foot in dorsiflexion with the knee straight, raise leg as high as possible and hold for a brief time. Repeat with other leg.

3. Patient lying prone. Have him contract the glutei muscles while the technician raises the straightened leg upward, supporting it there for a few moments. Repeat with other leg.

4. Exercises for loosening contracted adductors may also be taken in a sitting position, the legs hanging from a table. Hold one leg in place and

pull the other away as far as possible, the technician passively bringing the leg back. Repeat with other leg.

Exercises for the upper extremities: 1. An exercise for the head and trunk for the child with poor sitting position: If the head and body seem to drop forward, have the child reach for something held over its head high enough to cause stretching of the arms, the technician supporting the back. Grasp the body firmly with both hands and tell the child to push up slowly. These exercises must be repeated many times.

2. To loosen the shoulder, have patient in sitting position, then hold shoulder with one hand and gently rotate the upper arm describing a small circle. This exercise can also be done with patient lying on back by swinging the arm slowly and gently from the side to the shoulder level. This should be repeated several times but not to the point of fatigue.

3. To straighten the elbow, grasp the elbow in one hand in order to steady it; slowly, gently straighten the arm; bring the hand back up to the shoulder, and repeat as often as possible.

4. To relax the wrist, place patient's hand between those of the operator and gently but firmly straighten the wrist and hold as long as possible. Repeat but do not fatigue the hand.

5. To stretch forearm, hold child's elbow in one hand and grasp the hand in the other and gently supinate and pronate the hand. Be careful to keep elbow close to the body and not to twist the wrist, but move the whole length of the forearm.

6. Games and toys helpful in exercises:

a. For the smaller spastic child "pat-a-cake," "fly away birdie," "three blind mice," "church and steeple" are excellent for the hands and arms.

b. Balls are good after the child has learned to grasp them and is able to throw them in a given direction. It is not well, however, to begin with them as the child may be discouraged after a few futile efforts.

c. Tops are suitable for the turning-up movement of the right hand, in the older and stronger child. The top should have an upper part which must be placed on a lower one. The lower part is held in the "good" hand the upper part wound to the right by the more handicapped arm. The strongest finger of the injured hand pushes the lower part down, causing the spin.

Active exercises to induce rhythm: 1. Have the child slowly swing his arms in time to music, followed by swaying the upper part of his trunk from side to side.

2. If possible have several children present so that rhythm games can be played. The games should be chanted or sung slowly but with definite measure. Some of the old games for groups as "In and out the window," "This is the way to go to church," and "Ring around the rosy" are good.

3. Marching slowly swinging arms in time to music is effective. It is also helpful to have the child sing the words to the song while marching.

Relaxing exercises for throat muscles in vocal training: 1. After preliminary massage have child take normal and deep breathing exercises. Placing the fingers on the child's tongue steadies and helps relax it. First start with breathing the consonants as p — puh — etc. Do the same with the vowels. Have the child try to pronounce them on the tip of the tongue, the tongue and throat drawing up long enough to say the vowel, then relaxing. Take the vowels one at a time. Later the vowels may be strung along together to be sung out.

Exercises for the tongue in vocal training: 1. Push tongue out, making it point, then spread it and bring it back to a point. Touch first one corner of the mouth and then the other, now the upper teeth, then the lower with the end of the tongue. Move the tongue around in a circle. These exercises

may be evolved into a game, thus arousing the child's interest and engaging its cooperation. For the first words try those resembling noises made by animals such as "moo," "baa," etc.

a. Show the child a picture and call the name of the objects in it. Next, give the child short rhymes to learn and from here progress can be made by having the child compose short sentences to express a thought or a suggested idea.

b. Teaching the child to sing or whistle affords very good throat exercise.

c. Have the child sometimes practice word-sounding before a mirror. But, to repeat, the child must not be allowed to read aloud until such a time as it is able to enunciate in an understandable manner.

Traumatic and Functional Neuroses — Polmer

(*Continued from page 707*)

therapy gives this patient a basis for relinquishing his symptoms and offers a mental prop to hasten recovery.

Maison Blanche Building.

Discussion

Dr. John D. Currence: Dr. Polmer has presented some very careful studies of the type of cases he has illustrated, which have some practical implications.

I have gained the impression that there are more malingerers than Dr. Polmer's report gives. Possibly New York has more malingerers, in fact, I think insurance companies feel that the number of shyster lawyers is greater and there is more malingering in medicine in New York than in other parts of the country.

The main point which Dr. Polmer stressed is the history and diagnosis. The history of previous prolonged illness, of nervous conditions, hysteria, neurasthenia, and so on, aided by electrodiagnostics should soon determine whether or not physical therapy will give good results in neuroses. When a patient is referred for physical therapy, the main thing is that the referring physician is impressed with the necessity of a careful diagnosis.

One point that I might bring out is regarding Dr. Polmer's feeling that usually the physiological background of the treatment was not sufficient, but it was the therapeutic value alone. I think that in many of these cases there is an actual endocrine background. Williams and many others have felt that neurasthenia was accompanied by a marked hypo-adrenia in practically all cases and some authors have gone so far as to define neurasthenia as a type of hypo-adrenia. Certainly, in neurasthenics there is a definite abnormality in the function of the sympathetic nervous system, and I feel that physical therapy at the present time probably offers, by way of general circulatory and nerve stimulation, a better remedy and a better therapy than endocrinology, in many of these cases. The use of adrenal cortex has in some cases been described as very satisfactory, but where you have the syndrome of low blood pressure and rapid pulse, with cold hands and feet and frequent tingling of the toes and fingers, which so often accompanies these neurasthenics, opotherapy fails. Physical therapy does offer a real physiological background as well as actual therapeutic benefit.

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Editor: DISRAELI KOBAK, M.D., CHICAGO

EDITORIALS

POTENTIALITIES OF DECIMETER SHORT WAVE RADIATION

For the past few years there has been a division of opinion among authorities on the underlying causes of the therapeutic effectiveness of short wave radiation. One group has stood out on the basis of experimental data that certain wavelengths possess qualities effecting cell life by selective or even specific influences on different living tissues. Another group, especially one strongly represented in America has denied any such selective effects and has reduced the whole problem to deep thermic influences. While no doubt the element of deep heating constitutes a very important factor in the treatment of certain inflammatory infections and painful conditions, one is necessarily constrained not to negate the accompanying factor of other effects. This idea is forced upon observers by comparing results from apparatus of 30 and 6 meter waves.

More recently American and foreign physicists and biologists have submitted unusually interesting studies which are concerned with the effects of wavelengths considerably below one meter. While for a long time it was believed that apparatus of less than 3 meters offered a dosage which could not possibly have any therapeutic effect, the most recent investigations emanating from sources which command serious consideration appear to show the fallacy of such a negative attitude. This was a striking feature presented at the first International Congress for Short Waves in Physics, Biology and Medicine, held this summer in Vienna. Thus Okabe,[1] of Japan, demonstrated a new vacuum tube for producing very high frequency oscillations which in spite of their very low wavelength yielded a larger power with higher efficiency than has heretofore been attainable with the split anode magnetron tube. For practical operation this tube must be water cooled, for which an outside arrangement suffices.

Studying the absorption of ammonia gas by 1.25 cm. wavelengths obtainable from very small tubes devised by Cleeton of the United States Navy, Williams[2] of America proved that with such wavelength the absorption of

the gas amounted to 31 per cent. His experiments brought out the fact of especial interest for future clinical application; namely, that when the experimental container was filled with air the amount of absorption was virtually negligible. This demonstrates the probability that a wavelength of 1.25 cm. is capable of producing molecular absorption with implication of its influence on gases within living structure. It should be noted that these investigations were carried out with generators which are virtually unknown to clinicians interested in short wave therapy. The so-called magnetron oscillators represent a transmission system for which use is made of a small radio tube consisting of a copper anode with a metal-to-glass seal at each end, while a tungsten filament as a cathode is supported in the axis of the anode by these terminal seals. When this tube is in operation the oscillating voltage is developed along the filament, and the power is delivered to the antenna through a concentric tube transmission line, the inner conductor of which is an extension of the filament with the outer cylinder coupled to the anode. E. D. McArthur[3] of America, has pointed out that the arrangement just described is called a filament swing circuit.

Brünner-Ornstein[4] utilizing the Denier magnetron generator of a wavelength less than a meter presents in this issue a brief but informative report of pioneering research of immediate interest to the medical profession. While the details of her work are already a matter of record since they were published in *Strahlentherapie* of this year, the striking phase of her work indicates clinical possibilities if these ultrashort waves are administered in combination with x-radiation, especially in certain types of neoplastic disease that have proved resistant to x-ray therapy alone. Naturally the only logical conclusion is that these ultrashort waves produce changes in the cells not due to or associated with any heating phenomena. Her other observation that it is particularly the living tissue which appears most favorably to react to these minute wavelengths enhances the conclusion that this energy possibly possesses biophysical and biochemical properties which when completely correlated still influence the physiologic processes.

Measuring the dispersion and absorption of electric ultrashort waves in the region of 18-130 cm. with a modified Drude-Coolidge method and a Lecher system, Keutner and Potapenko[5] proved that absorption was selective in nature. They confirmed to a great extent the theory enunciated by Debye. This in itself is an important contribution because it authoritatively raises the question whether selectivity and specificity are not functions of decimeter wavelengths irrespective of the presence or absence of concomitant heat.

Without any more definite claims than have been advanced by the authors cited above, sufficient data have been presented to arouse both physicians and physicists to more intimate collaboration in this new field, which holds out even on theoretic grounds possibilities of indeterminable value in the field of physical therapy.

References

1. Okabe, Kinjiro: Electron-Beam Magnetron, Internationaler Kongress für Kurzwellen, Wien (July) 1937.

2. Williams, N. H.: Electromagnetic Waves of 1 cm. Wavelength and Their Absorption by Ammonia Gas, Internationaler Kongress für Kurzwellen, Wien (July) 1937.

3. McArthur, E. D.: Recent Developments in Magnetron Oscillators, Internationaler Kongress für Kurzwellen, Wien (July) 1937.

4. Brünner-Ornstein, Martha: Experiments and Treatments with Decimeter-Waves, Arch. Phys. Therap., X-Ray, Rad. 18:684 (Nov.) 1937.

5. Keutner, E., and Potapenko, G.: On Dispersion and Absorption of Ultrashort Electric Waves, Internationaler Kongress für Kurzwellen, Wien (July) 1937.

OBESITY AND CHARLATANRY

"Your waist line is your life line" is a slogan placed by many public health organizations on scales in public buildings to enable passers-by to check their weight. This has made the American public "fat conscious," so that the propaganda undoubtedly has accomplished much good. Unfortunately the great mass of ethical physicians, and especially those engaged in general practice or specializing in physical therapy, who should be the legitimate beneficiaries of the propaganda have failed to derive full benefit from it, while charlatans and self-styled health cultists have exploited the situation for their great material benefit.

Taking the average "health club" run by some layman or group of men without any medical training as a criterion, one wonders why it is that these "organizations" almost without exception are financially prosperous while hundreds, nay thousands of well-trained and conscientious physicians, especially those living in large cities find it difficult to make both ends meet. The usual answer that the medical code of ethics prevents them from effectively competing with lay enterprises that can make clever appeals to the public, does not solve the problem. Physicians do not have to stoop to methods that have been declared unethical centuries ago, if they will only apply a modicum of tact with their own clientele. There is not a general practitioner extant who does not see a comparatively large number of patients blessed or rather cursed with exogenous adiposity. In the majority of instances such patients consult a physician for some other ailment and this so attracts the attention of all concerned that the problem of overweight is either not mentioned at all or only casually. Under any circumstance the common transaction takes the form of the physician either suggesting a suitable diet and exercise or acceding to a request for a diet list. As regards exercise men patients usually assert that their daily work cannot be interrupted, and that at the conclusion of the day's business they are too tired to do more than smoke a pipe while reading a newspaper. Women patients profess the same disinclination to physical exertion, owing to their manifold household duties and fatiguing social obligations. If physicians were in a position to investigate the actual facts, it will be discovered that a goodly number of their male patients break away from their offices to spend an hour or two in some health club or gymnasium in the hope of reducing their ungainly rotundity, while the ladies find time enough to patronize massage parlors or beauty salons.

Of the qualifications of the men in the health clubs the following is an impartial picture. Ordinarily a man who has earned a living in the muscle industry, such as the gloved or rosin craft, and finds himself on the list of managers labeled "ex," hits on the idea of capitalizing on his muscular development and possibly cauliflower ears by opening a "gymnasium" or a "health club." The difference between the two is a matter of physical equipment. The former has a few punching bags, an array of dumb bells and possibly also a shower bath or two, while the latter has vapor cabinets, superannuated lamps of considerable wattage and couches on which employes with brawn give the patrons rub downs and "passive" exercises in comparison with which the manipulations of osteopaths, chiropractors, napropaths *et id genus omne* are delicate strokings.

That there are men who endure this sort of thing is a fact, though if asked for the reason they give incongruous replies. Most often it will be found that these patrons lack the moral and physical energy to take graded walks suggested by their physicians and feel that they can attain the same results by allowing some ex-pugilist, who knows as much about muscles

and nerves as a peasant of Sanscrit, to jerk him about in diverse directions, which he takes lying down.

The ladies who require some energy for the exhausting work of playing bridge for long hours after supper go through similar experiences, albeit the rough part is somewhat modified through the "feminine touch."

Physicians whose daily work is of a nature necessitating long office hours, that is those who make few calls and have little if any work in hospitals, certainly need not spend idle hours if they will not remain content to dispense diet lists and the advice to "take some exercise" to such of their patients whose "pleasing plumpness" is not the result of some endocrinic disturbance. The physicians should realize that the diet lists will be carried out in the breach, that "some exercise" will not be taken, and that sooner or later they will resume their old culinary habits but seek some willing though untrained hands to do the exercising for them. By this we are far from implying that physicians should imitate the ex-pugilists or similar gentry by opening gymnasiums, rubbing and bath houses or hair dressing "establishments" provided with a "cultural annex." There is no need for all this, though physicians employing masseurs and masseuses will, of course, make full use of their work. What each practitioner without such elaborate equipment can do, is to explain to each patient that he or she needs treatment that will develop individual muscles or groups of muscles, as the case may be, and that the means of stimulating such muscles must be graded with the same exactness as one weighs drugs.

Among the apparatus undoubtedly best suited for the purpose under consideration are those providing sinusoidal currents. Such an equipment is comparatively inexpensive, not difficult to use so far as technic is concerned, and easily applied to produce the best attainable physiologic effects. True, one must be familiar with the nature and effects of the current at various intensities, but the physician who has not completely lost his anatomicophysiologic grounding will not have to consume much midnight oil before obtaining a full grasp on all concerned problems. Here then is a good opportunity to accomplish much good, and at the same time to inculcate in the minds of thinking men and women that there is no room in the modern community for medical quackery because of the inherent perils when ignorance ventures to dabble with men's most precious possession — health.

Fibrositis — Krusen

(*Continued from page 697*)

13. Wilson, Justina: Fibrositis, Physiotherapy Rev. **13**:14 (Jan.-Feb.) 1933.

14. Sutro, C. J.: Subcutaneous Fatty Nodes in Sacroilliac Area, Am. J. Med. Sci. **190**:833 (Dec.) 1935.

15. Slocumb, C. H.: Differential Diagnosis of Periarticular Fibrosi is and Arthritis, J. Lab. & Clin. Med. **22**:56 (Oct.) 1936.

16. Dawson, M. H.: Discussion.[15]

17. Hunt, L. W.: Diagnosis and Treatment of Fibrositis and Myositis, Med. Clin. N. Amer. **21**:257 (Jan.) 1937.

18. Mennell, J. B.: Massage, Its Principles and Practice, Ed. 2, Philadelphia, P. Blakiston's Son & Company, 1920, p. 535.

19. Alexander, J. C.: Some Observations on Physicotherapy in Treatment of Fibrositis and Other Rheumatic Conditions, Glasgow M. J. **123**:350 (June) 1935.

20. Cecil, R. L.: Discussion.[15]

THE STUDENT'S LIBRARY

D'ARSONVAL. Soixante-cing ans à travers la Science. (D'Arsonval. Sixty-Five Years of Science.) Par. *Dr. Louis Chauvois.* Lauréat de l'Institut et de l'Académmie de Médecine. Pp. 440 with 136 photographs, drawings and other illustrations. Price, $4.00. Paris: J. Oliven, 1937.

An evaluation of the life accomplishments of the illustrious French savant d'Arsonval could only have been prepared by a physician thoroughly familiar with the countless path finding experiments by the greatest living electrophysiologist. Chauvois has not only such a qualification, but possessing unusual literary talent, coupled with the keen eye of the historian and the warm heart of the personal physician of the savant and his family and admiring friend, he of all men could produce this work which is a monument to the genius of the discoverer of the physiologic and biophysical properties of the high frequency current. The large volume is a biography of Professor d'Arsonval and yet much more than that. Chauvois has drawn for us an authentic picture of the master's life as a child, student, teacher and patriot. His fluent story is often given a touch of realism by autographs in facsimile, by photographs of scenes and events. That part of the work may well be designated as a human document; for apart from being replete with details that have never been published, it shows the master as a living, thinking human being vitally interested in science and humanity, but also in the weal of his great country. It opens with a description of the master who at the age of 85 is as alert as he was when as a pupil of Claude Bernard he passed the first portal to the temple of physiology and medicine. Then he uncovers the past, the child, the growing youth, the student, the assistant and laboratory worker. This sketch also contains a highly interesting chapter on d'Arsonval's work during the World War. Out of a total of eleven chapters more than half are devoted to a complete survey of d'Arsonval's scientific labors. He passes in review the youthful efforts to delve into the secrets of the human machine, with particular reference to animal heat, his research in the vast domain of industrial electricity. The restless spirit next seeks the very essence of animal electricity and internal secretions, the beginnings of high frequency therapy and the gradual development of its manifold problems until the great savant has all but accomplished his life's task. These chapters contain more than a hundred illustrations of apparatus, experimental observations, graphs. The volume concludes with a full account of the proceedings of the great national, nay international jubilee accorded him by his country and by foreign institutions of learning and men distinguished in the world of science, in which American participation is treated with particular consideration. Chauvois has rendered the cause of modern electrophysiology and electrotherapy a great service. The book may well be regarded as the alpha and omega of the history of diathermy and short wave diathermy as personified by its discoverer. No physician interested in physical therapy can afford to miss perusal of this magnificent work, which is a veritable inspiration for all men in search of scientific truths. It may well be regarded as a beacon pointing the way to the highest ideal in medicine and especially physical therapy. It is hoped that some far-seeing publisher will bring out a translation for the English speaking medical profession, as such an addition to the available literature would prove of enormous value for a full appreciation of the electrical energies so widely used in modern therapy.

PHYSICAL THERAPY IN ARTHRITIS. By *Frank Hammond Krusen,* M.D., Associate Professor of Physical Medicine, The Mayo Foundation, University of Minnesota; Head of the Section on Physical Therapy, The Mayo Clinic. Cloth. Pp. 180, with 21 illustrations. Price, $2.25. New York: Paul B. Hoeber, Inc., Medical Book Department of Harper Brothers, 1937.

This small volume automatically recommends itself to every physician interested in arthritis because of two inherent virtues: It reviews and analyzes the pain relieving and function restoring qualities of physical therapy in a concise and simple style, while permitting the reader to draw his own conclusions from source references as rich as they are authoritative. Intended as a guide for general practitioners who perhaps more than any other group have the great responsibility for the care of the large number of arthritics in this country, it possibly points out the cross current of outstanding opinions on the merits and limitations of physical methods for institutional and home treatments under medical supervision, and of benefits to be derived from such broad procedures as heat, massage, exercise and rest. Krusen is to be commended for his practical exposition which helps to clarify the many therapeutic advantages that may be derived from the proper employment of certain physical agents, and more so, because he has been of the few to point out the importance of rest as a valuable regimen on the basis of restorative qualities. Few regard prescribed rest as an important adjuvant in therapy, and equally as few appreciate it as a part of the discipline of exercise — static in action but dynamic in reaction. Henderson in his foreword, generously commends the labors of Krusen and calls attention to the practical need of such a small but critical volume for use of the general practitioner. He emphasizes that the very kernel of the exposition lies in the author's gently stripping these "remedies of their spurious finery" and presenting them in their true value, an exposition so judicial as to impress him and no doubt the read-

ers with the selection of the facts and their evalution for practical purposes. In the twenty chapters and the large number of appended references, the author has succeeded in condensing the major opinions on practically every modality used in physical therapy. He discusses the various methods of heat application, certain forms of hydriatic procedures, heliotherapy, massage, exercise, manipulation, types of shoes, bandages and supports, occupational and electrotherapy, iontophoresis with histamine and acetylcholine products, and the like. Accordingly, wherever books are judged by their content rather than their size, this work will be regarded as one of the keenly critical and informative contributions for the guidance of the general practitioner in the application of physical measures in arthritis.

TEXTBOOK OF SURGERY. By 184 American Authorities. Edited by *Frederick Christopher*, M.D., F.A.C.S., Associate Professor of Surgery, Northwestern University Medical School; Chief Surgeon, Evanston Hospital. Cloth. Pp. 1628, with 1349 illustrations on 730 figures. Price, $10.00. Philadelphia: W. B. Saunders, 1936.

This one volume textbook is noteworthy not only because it represents the combined efforts of no less than 184 collaborators, but because the text affords the medical student and general practitioner precise information on conditions they are most likely to encounter in daily practice. The book is also of especial value because it is free from padding with controversial problems, so that the reader obtains terse, clearly stated facts based on sound principles and information on operative procedures that have proved to be simplest and most effective. With the classification of each disease and condition are given the etiology, pathology, symptomatology, diagnosis, methods and technic of examination, laboratory tests, non-operative and operative treatment. The illustrations are excellent. It can be highly recommended to every medical student, general surgeon and general practitioner. It should become THE Textbook of Surgery.

EXPERIMENTAL BASES OF SHORT WAVE THERAPY (Experimentalniye Obosnovaniya Korotkovolnovoy Terapii). By *G. M. Slavsky*, M.D. Pp. 383 with 93 illustrations and 41 tables. Sevastopol, U. S. S. R.; Sechenovsky Institute, 1937.

The present volume is the second one to be issued by the well known Russian Institute on the subject of short wave radiation. It is divided into six principal sections or parts and many subsections. The author opens his presentation with an historic sketch and discusses the nomenclature, the physical bases of heat effects and continues with experimental and clinical investigation of hyperpyrexia. Indications, actions and the risks incident to this method are given in detail, followed by an exposition of the morphologic reactions of living tissues in a condenser field. An important part takes up the relation of the short waves to the vegetative system, exhibiting the influence of radiation on the cardiovascular system, the eyes and endocrine glands. The author critically reviews all known and not widely known theories pertaining to selective heating, specificity, biophysical and biochemical actions, and the like. The work concludes with the indications and contraindications of short wave therapy with stress on the means of securing proper dosage. So far as definite conclusions are concerned, the author appears to consider the thermic effect in therapy to be the dominant quality of the short waves. Of especial interest is an exhaustive study of neurosyphilis. While it does not lend itself to a review, it is pointed out that Slavsky has used a new method of treatment, at least one not found in the literature. The world literature has been considered by him, the work being replete with quotations especially from American authors. There is no question but that this book should be translated, partly because it covers the entire subject without a single omission, and partly because the fruits of the author's painstaking labors through a number of years will prove of enormous benefit to earnest workers, both experimentally and clinically.

ANATOMY AND PHYSIOLOGY OF PHYSICAL TRAINING. By Major *R. H. Galloway*, D.S.O., Ch.B., R.A.M.C. Hygiene Specialist Army School of Physical Training, with an introduction by *E. P. Cathcart*, LL.D., M.D., D.Sc., Regius Professor of Physiology, University of Glasgow. Cloth. Pp. 182 with 42 illustrations. Price, $2.50. Baltimore: William Wood & Company, 1937.

This treatise is a welcome departure from past expositions on physical training that stressed the benefits of muscular development and extolled the beauties of physique as the alpha and omega of physical gymnastics. With the increasing conciousness of the value of man power for unanticipated eventualities and the relationship of preventive medicine and hygiene toward clinical practice, physical training assumes today a new importance in the eyes of the profession. Its stabilizing influence must be explained on health consequences more important than statuesque brawn or muscular appeal. Galloway's small but important contribution points out that the psychophysical end result of intelligently directed gymnastics has a more important basis than the attainment of vivacious charm or exaggeration of muscular contour. He emphasizes that the physiologic stimulus consequent to persistently well controlled physical training, sets off a series of reactions of great benefit to health and happiness of the individual under such influences. Thus the facts are stressed that any organized action of muscles brings about a psychophysical reaction which favorably influences the physiologic processes of each participant. It therefore has a definite effect on the more vital centers and a more lasting end result than the shortsighted objective of mere muscular development. The book is divided into two sections, and these into twelve concise chapters. The first section deals with the principles of anatomy and physiology, pointing out the intimate relationship of the volitional act and the train of physiologic reactions set into motion; the second part discusses the practical application of typical exercises and their prin-

ciples to supervised training. The work comes highly recommended by Professor Cathcart whose foreword may be considered as the best resumé and reason for its acceptance by medical and physical training schools for army and lay institutions.

DISEASES OF THE NOSE, THROAT AND EAR. A Handbook for Students and Practitioners. By *I. Simson Hall*, M.B., Ch.B., F.R.C.P.E., F.R.C.S.E., Surgeon to the Royal Infirmary, Edinburgh (Department for Diseases of Nose, Throat and Ear); Lecturer in Diseases of Nose, Throat and Ear, University of Edinburgh. Cloth. Pp. 423. Price $4.00. Baltimore: William Wood & Company, 1937.

This volume is designed to meet the needs of the busy practitioner and the student with the knowledge of the author that it is thus limited in its aim. "No attempt is made to describe in elaborate detail diseases of the Nose, Throat and Ear which the student and practitioner, for lack of training, might fail to recognize. For the same reason there are not a few omissions, but that is balanced by a fuller discussion of the commoner complaints." It is quite obvious that the specialist will not be impressed with this work—a mere synopsis—so to speak, but for those for whom it is intended, it should find a field. The illustrations are too few in number. The student gains considerably from good illustrations and seeks them even in a small work. The arrangement of the material, the style and general plan of the book are good.

HUMAN EMBRYOLOGY AND MORPHOLOGY. By *Sir Arthur Keith*, M.D., F.R.S., LL.D., D.Sc., F.R.C.S. (Eng.); Master of the Buckston Browne Research Farm; formerly Conservator of the Museum and Hunterian Professor, Royal College of Surgeons of England. Fifth Edition. Cloth. Pp. 558. Price $10.00. Baltimore: William Wood & Company, 1933.

Embryology has developed into one of the important courses in the medical curriculum. Since the previous edition of this book in 1923, "Embryologists have been very busy and our knowledge of the human embryo, particularly of its earlier stages, has made great advances. The chief change which has taken place since the Great War relates, however, not to the accumulation of embryological facts, but to their interpretation." The book has increased in its number of pages and illustrations, but the greatest improvement relates to the manner in which references to recent publications are dealt with. There are 30 chapters which embrace the field exhaustively. The student will find all the material he requires for study of assignments while the clinician has available a veritable encyclopedia for reference, dealing with every phase of human embryology and morphology. This being the fifth edition is in itself a tribute to the author, for no text goes through successive editions unless its merit has been proved. The book is to be recommended especially because of its authentic contents and the fact that the material has been brought down to date.

METABOLISM OF LIVING TISSUES. By *Eric Holmes*, M.A., M.D.; Fellow and Tutor of Downing College and University Lecturer in Biochemistry, with a Foreword by Professor *Sir Gowland Hopkins*, O.M., F.R.S., Professor of Biochemistry in the University of Cambridge. Cloth. Pp. 235. Price $2.25. Cambridge: The University Press, 1937.

This book attempts to survey present day knowledge of dynamic biochemistry for the benefit of those interested in the more restricted field of medicine as compared to the broader field of biology. Presented by a teacher of wide experience in biochemistry on a topic synonymous with that taught in American schools under the name of physiologic chemistry, the work stresses the activity of living tissues rather than the material which their actions transform. Holmes points out as justification of his contribution, that there is need to correlate with any survey of the interplay of the chemical changes noted in living processes associated with enzyme action, oxidation mechanisms and the chemistry of vitamins and hormones, a consideration of the metabolic activity of various other tissues of the body rather than a technical exposition of the chemical changes taking place in the protein molecule. The objective of this work is therefore to present an adequate exposition of all that is most significant in our present day knowledge of the dynamic side of biochemistry, a fact which Professor Sir Gowland Hopkins in his foreword calls attention in his laudatory solicitation for its wider consideration by beginning and advanced students of biochemistry. As an introduction to this important branch of medicine it offers a thorough digest of such vital topics as the metabolic function and nature of enzymes; cellular activity; oxidation and reduction; the role of the liver in metabolism of nitrogenous and carbohydrate material; the kidney, heart and nervous system; the hormones and vitamines, and the like. It is to be regretted that the value of certain books are often stressed for the student entering medicine but not for the one who is actually engaged in its practice. For the latter this erudite and practical treatise will have as great a meaning and perhaps a greater appeal because it deals with a subject which has useful implications not appreciated by the undergraduate of medicine.

INNERE SEKRETION UND KONSTITUTION IM KINDESALTER, PHYSIOLOGIE, PATHOLOGIE UND KLINIK. Von *Prof. Dr. Edmund Nobel*, Primararzt am Mautner-Markhofschen Kinderspital der Stadt Wien, *Dr. W. Kronfeld*, *Dr. A. Roland* und Doz. *Dr. R. Wagner*. Pp. 352 with 125 illustrations and 15 charts. Price Rm. 25.00. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago), 1937.

Unlike many other foreign monographs on this subject the present work is devoid of padding and tersely covers the subject of internal secretions in childhood with encyclopedic thoroughness. The work opens with the histology of ductless glands and various tables and methods of computing hereditary

influences. While this material in the first chapter is perhaps of greater interest to the student of heredity than to the clinician, it furnishes a fascinating introduction to the subject of endocrinology and facilitates an understanding of organotherapy as applied in the practice of pediatrics. This is stressed because our present practice of endocrinology is still based largely upon certain empirical considerations emanating from sources of questionable scientific value. The text is enriched by many splendidly executed half-tones, most of them being "before and after" photographs, which illustrate the almost miraculous transformations attained by the conservative and judicious use of organotherapeutic preparations. An interesting and important feature of the book is a tabulated list of the various hormones, their functions and pharmacology. It contains all the recognized American and foreign preparations with concise annotations as to dosage, manufacturer and source of origin. It is refreshing to peruse this work which covers the subject so thoroughly in readable language within the limits of its size. To all interested in endocrinic disturbances in children the book is a most valuable source of exact information.

CHILDREN HANDICAPPED BY CEREBRAL PALSY. Psychological Factors in Management. By *Elizabeth Evans Lord*, Ph.D., Psychologist to the Children's Hospital, Boston,; Research Associate in Pediatrics, Harvard Medical School. With a Medical Explantion by *Bronson Crothers*, M.D., Visiting Physician to the Children's Hospital and to the Infant's Hospital, Boston; Associate Professor of Pediatrics, Harvard Medical School. Cloth. Pp. 105. Price, $1.25. New York: The Commonwealth Fund, 1937.

The Children's Hospital of Boston is noted for its work with patients handicapped by cerebral palsy. The treatment of cerebral palsy aside from surgery, consists of a series of exercises designed to relax and develop the muscles and to bring them under voluntary control. The first chapter by Crothers gives an orientation to the medical aspects of cerebral palsy. The remaining chapters by Lord develop the exposition on the physiological aspects of muscle training, the mental testing program, mental growth in relation to educational plans, the teacher's problems and the emotional considerations of the spastic child and the parent. In spastic children the physical and mental residue is not necessarily fixed since growth and proper educational methods may increase the adequacy of the intact remainder. The field for the application of physical therapy for these cases is in direct relation to the appraisal of the growth of assets in these damaged functions. In most medical textbooks one finds discussions of the various physical disabilities of the spastic child and their treatment, but the psychologic factors are largely ignored. This book stresses this phase and should be in the library of everyone treating children handicapped by cerebral palsy.

RADIATION THERAPY. Its Use in the Treatment of Benign and Malignant Conditions. By *Ira S. Kaplan*, B.Sc., M.D., Clinical Professor of Surgery, New York University Medical College; Director Radiation Therapy Department, Bellevue Hospital, New York; Director, Division of Cancer, Department Hospitals, City of New York; Director, New York City Cancer Institute; Associate Radiologist, Lenox Hill Hospital, New York; Editor (Therapeutic Section) Year Book of Radiology. Cloth. Pp. 580, with 198 illustrations. Price, $10.00. New York: Oxford University Press, 1937.

The advances made in the management of a large variety of diseases by the application of the x-rays and radium, have created a long felt need for a concise, authoritative manual as a reliable guide through the complexities of the indications and technic of radiation therapy. Kaplan has admirably filled this need, his great experience and sound judgment, combined with excellent scholarship, having enabled him to prepare in understandable language a textbook whose contents have been well thought out and organized. The author has gone even farther than the title of the book indicates, in that he has been motivated by a desire to familiarize the reader with the historic background and the involved physical fundamentals of this branch of general therapy. The strictly clinical part covers all diseases and disease processes beginning with those of the skin, continuing with all organs of the body terminating with neoplasms in which some form of radiation has proved effective. Many of the conditions are graphically illustrated as well as thoroughly described from a purely clinical point of view. Nor has the author failed to caution about the dangers incident to improper use of radiation. Finally even nursing care and the problem of the relation of trauma to cancer are some of the non-clinical but highly interesting subjects included in the volume. Both the author and the publisher have accomplished a task meriting full recognition as a valuable addition to the literature of radiotherapy. The work comes to us in a dignified dress, print, paper and binding being in keeping with the worth of the book.

INTERNATIONAL ABSTRACTS

Physical Therapy of Neurosis (Die physikalische Therapie der Neurosen). Erich Wellisch.

Die ärztl. Praxis **8**:291, 1936.

Physical therapy of neurosis is not a treatment by suggestion, as many believe. There does exist a suggestive action in physical remedies. Moreover, the physical procedures often exert an important somatic influence on neurotic patients, as by bringing about improvement of physical health they react markedly and beneficially also on the diseased inner life. Furthermore, physical treatment offers special favorable conditions for simultaneous psychotherapy. Hence three components are included in the effects of physical therapy, viz., (1) the somatic effect, (2) the suggestive effect, and (3) a receptive state for psychotherapy. Best results of physical therapy in cases of neurosis were observed in the application of hydro- and balneotherapy. The effects of cold water on the vascular system are important. By contraction of the skin vessels in the beginning and subsequent dilatation, the circulation is stimulated. Cold presents also a direct chemostatic stimulus of the leukocytes resulting in leukocytosis in the periphery of the skin and stimulation of the natural defensive forces in the blood. In addition short stimulation of cold enhances the efficiency of the striated and non-striated muscular system, since in stimulating the circulation, waste products are carried off. Along with hydrotherapy, massage is also applied in neurosis, as a stimulus of the circulation and metabolism.

Galvanization lowers the sensitivity of nerves and produces a reflex alteration of the visceral nervous system through stimulation of the skin. In general debility local frictions are sufficient. Hip-baths, starting with a temperature of 34 degrees C. are slightly more effective. Next to this a series of fixed applications of showers and massage is given, during which the water is cooled by 4 degrees. To strong persons a sharp, short, cold or alternating cold and warm shower may be administered. General frictions produce the strongest effect. With increased irritability warm plunge-baths (36-37 degrees C.) of 10-20 minutes duration are advisable. In case of insomnia moist packs have a good effect; protracted lukewarm plunge-baths of an hour's duration are an excellent soporific. With headache due to plethora in the brain, cooling caps or foot-baths in cold, running water may prove advantageous. If vasomotor symptoms occur, including those accompanying exophthalmic goiter, cool applications have to be utilized, since warm or hot ones would exaggerate the condition. In endocrine disturbances general galvanization acts extremely well in association with moist packs, subsequent hip-baths and massage. Galvanization is applied either in the form of a 4-cell bath or of an electric plunge-bath.

Artificial Fever Therapy. Carlyle Haines, and James M. Flood.

Guthrie Clinic Bull. **6**:185 (April) 1937.

A method is presented for producing high and prolonged fever by means of a humidified luminous heat cabinet. Hyperpyrexia of 106.7 degrees F. for a period of six hours is a very satisfactory method of treating gonorrhea and its complications. It is also of definite value in the treatment of syphilis and chorea. Severe complications are not common but superficial burns and herpes may occur in many patients. With such a heroic form of treatment there are, of course, dangers connected with its application. Thus, it is very important to select carefully only the best risks for treatment. Deaths do occur and they are not always in poor risks. It is important to check the patient carefully and where there is any doubt, blood, heart and kidney function should be investigated thoroughly. As a rule it is not wise to treat a patient over fifty years of age. The blood studies consist mainly of urea, sugar and chlorides. If the latter are reduced, sodium chloride is given for several days before the treatment..

Practical Clinical Photography. Lewis R. Wolberg.

J. A. M. A. **108**:197 (Jan. 16) 1937.

The development of emulsions sensitive to the infra-red portion of the spectrum has introduced a new phase of clinical photography. Detail below the surface is apparent where visible light does not penetrate. Work done with infra-red emulsions in medicine indicates that the method is chiefly applicable to the study of some skin diseases, the superficial venous system, gross pathologic specimens and, to some extent, photomicrographs.

Infra-red photography is especially suitable for varicose veins and other disorders of the superficial venous system. Most of the infra-red photographs of skin lesions have shown what might be termed negative results; that is, details visible to the eye and recorded in a visible light photograph are invisible in the infra-red picture. This apparent disappearance of the lesion is of value in cases of lupus and similar conditions under treatment with ultraviolet rays, since it makes it possible to visualize the progress of healing under the thick scab formed and also reveals the presence of enlarged veins in the lesion.

In photomicrography of histologic specimens stained with the usual dyes, the use of infra-red sensitive materials is not generally recommended, since most of the dyes used are transparent in this portion of the spectrum. It is of value, however, in photographing silver impregnated specimens, making those portions which have taken up the silver stand out in bold relief. It is also of value in photomicrography of insects that possess a chitinous exoskeleton, since the infra-red rays readily penetrate this substance, revealing the nature of the innermost structure.

Roentgenology and Hypophysis (Röntgenologie und Hypophyse). Arthur Schueller.

Wein. klin. Wchnschr. **49**:1259, 1936.

For x-ray treatment of the hypophysis area one must first recognize whether these tumors are eosinophilic and basophilic in character, the latter forming the underlying basis of acromegaly and giant growth on the one hand, and of Cushing's disease on the other. In such affections roentgen treatment is supposed to lower the functions of the gland by controlling the excessive growth in gigantism and acromegaly. Besides the endocrine improvement, it will also favorably effect the so-called neighboring pressure symptoms such as headache and visual disturbances. Further indications for treatment of the hypophysis area are: Syndrome related to the vegetative glands; namely, exophthalmic goiter. Radiation of the hypophysis area may be applied subsequently or simultaneously with those of the thyroid gland. In ovarian disturbances Schueller mentions its value in amenorrheic and climateric difficulties, in particular insomnia during the menopause, and functional sex impotency in the male.

Present Time Lupus Treatment (Lupusbehandlung von heute). Erhard Riecke.

Fortschr. d. Therap. **12**:513, 1936.

When easy of access, total electrosurgical extirpation of the lupus focus in addition to sectional x-ray treatment followed by simple ointment dressing has proved successful. With surgical diathermy occlusion of the lymph passages and of the capillary vessels takes place and prevents infection of the surrounding area. Tuberculides of the skin can also be removed locally by chemical therapeutic actions (20-30 per cent resorcin pasta zinci, 25 per cent chinine ointment, 5-15 per cent pyrogallic ointment).

Light therapy has received increasing recognition for lupus conditions. It acts locally influencing the foci of disease, which tends to produce regression of lupus changes. Local light therapy consists in the use of carbon arc light with the added aid of Finsen's lamp. Natural sunlight has a profound therapeutic effect but is not applicable for constant use on account of changing seasons. Where unavailable carbon arc light is a well qualified equivalent for sun light. Also the use of the quartz mercury lamp by means of Jesionek's super alpine sun light is commonly attended by biologic results. X-ray treatment for lupus vulgaris is still a disputed method. Actually the foci of lupus may be successfully removed by x-rays. The procedure, however, is fraught with danger and requires much experience and a highly developed technic. Good results have been reported with Grenz ray treatment of lupus, but one is warned against the use of very high dosage. If it is a matter of a small circumscribed focus of lupus, radium and mesothorium may be taken into use.

Treatment of Occlusive Arterial Disease of the Extremities by Passive Vascular Exercise. Report of Sixty-eight Cases. Horace Marshall Korns, and Alto Edmund Feller.

Arch. Int. Med. **59**:705 (April) 1937.

Passive vascular exercise is not a panacea and should not be employed indiscriminately. In the group reported by Korns and Feller only the immediate consequences of frost-bite and arterial insufficiency secondary to local anesthesia proved amenable to treatment by this method. Their experience indicates that if collateral pathways are potentially adequate, passive vascular exercise helps to re-establish the circulation in an extremity which has been deprived of part of its blood supply by obliterative arterial disease.

Treatment of Epithelioma of Lip by Electrodesiccation. Howard Morrow; Hiram E. Miller, and Laurence Taussig.

Arch. Derm. & Syph. **35**:821 (May) 1937.

The purpose of this paper is to describe a technic for the treatment of early stages of epithelioma of the lip which can be readily carried out on ambulatory patients in the dispensary or in the private office of the dermatologist. For the past five years the authors have regularly treated epithelioma of the lip by means of curettage followed by electrodesiccation. The technic is described in detail. The clinical and cosmetic results were apparently as good as those which followed classic surgery. The method is recommended on the basis of its effectiveness, of the ease with which it can be applied and of its small expense to the patient.

Oxygen and Carbonic Acid Treatment (Ueber Sauerstoff—und Kohlensäuretherapie). Herbert Elias.

Wien. klin. Wchnschr. **49**:1369, 1936.

Lack of oxygen may abruptly take place in suffocation; it may occur by degrees from a slow suppression of the air supply as in diphtheria and croup. In both conditions an over-saturation of CO_2 will be present along with the lack of O_2. On high altitudes (on mountains or in an airplane) lack of O_2 may occur even in the absence of CO_2 saturation. In any of these condi-

tions O_2 inhalation is advisable, pure O_2 inhalation, when it is a matter of real suffocation. In other cases an addition of 3-5 per cent CO_2 should be introduced in order to better respiration. Pure O_2 inspiration above a normal level leads to apnoea.

Oxygen therapy, in particular, is indicated for all cases of obstructed air-passage, e.g., for bronchioli, alveoli (possibly due to exudation in case of pneumonia or tuberculosis), changes in the epithelium of the lung alveoli, emphysema, war-gas poisoning, also insufficient ventilation of the alveoli due to outside pressure as with pneumothorax, pleural effusion and the like. Oxygen therapy is equally indicated for Cheyne-Stokes syndrome for diseases of circulation and for anemia. If in such conditions there is damage to the O_2 cell supply, a special respiration apparatus (according to Draeger) offers a chance to continue O_2 respiration for a long time at a moderate expense. This form of treatment is not merely applicable by the pulmonic rout, but may be injected by subcutaneous and intravenous methods. It is also applied by means of baths, Ozet-bath, a sparkling oxygen bath.

A more important therapy deals with CO_2 baths. It has been ascertained by science that CO_2 passes into the body by way of the skin. In fact a CO_2 bath of 5 to 10 minutes produces a subsequent effect of CO_2 secretion to a high degree for 3-4 hours. At the same time CO_2 in cool baths acts by retarding the pulse, enlarging the peripheral vessels, lowering the pressure in most cases, and raising the output of heart and the changes in volume per minute. The capillary and pre-capillary vessels of the peripheral heart act in reducing the function of the central heart. Its effect is like digitalis. Nearly all disturbances of circulation including those due to anemia are indicated for CO_2 treatment. On the other hand contraindications are to be emphasized whether these be located in the heart, lungs, or limbs, all distinctly decomposed disturbances of circulation, the majority of intoxications, chiefly uraemia and febrile conditions, especially in the presence of endocarditis.

Effect of White and Infra-red Light on Skin. (Ueber die Wirkung des weissen und infraroten Lichtes auf die Haut.) G. Miescher; E. Hardmeyer, and L. Guggenheim.

Arch. f. Dermat. u. Syph. **174**:445, 1936.

No evidence of a photochemical effect on the normal skin is obtainable with practicable measures (concentrated strong arc light) neither when white light, short waves nor long wave — infra-red were applied. Comparative investigations about biologic stimulation thresholds for white light, red light, short wave and long wave infra-red resulted in a maximum of tolerance in short wave infra-red (with about 800-1300$\mu\mu$) and in a minimum in long wave infra-red. It is believed that there is a direct relationship with the penetration of irradiation. The results obtained from great radioactive intensities are merely effects of heat due to local absorption of radiation. Clinically and histologically the course of radio-heat actions is characterized by slow development of the injury, torpid progress, and almost complete relief of pains. The more penetrating the radiation is, the more retarded is the healing process.

The limit of injury to the tissue is marked by a temperature of 50 degrees C. In the case of bacteria (staphylococci) as contrasted with the skin, bio-negative effects occur in almost the entire range of visible light as far as orange (600-625$\mu\mu$). These effects are most likely to be attributable to the existence of sensibilisators lacking in the normal skin.

Measurements of Temperature of Maxillary Sinus After Treatment by Various Methods of Heating: A Comparative Study. M. A. Andreen, and S. L. Osborne.

Arch. Otolaryng. **24**:331 (Sept.) 1936.

Measurements of the temperature of the antrum were made after treatment by diathermy, the electromagnetic field, the thermospectral lamp, the Cutler water-cooled lamp, compsolite, short wave diathermy and the Elliott machine. Their ability to produce heat in the antrum was in the following order: (1) electromagnetic field and diathermy, (2) thermospectral lamp, (3) cutler water-cooled lamp, (4) compsolite, (5) short wave diathermy and (6) the Elliott machine. (Note:—It is of scientific interest to call attention to certain discrepancies between the reports of the above authors and work previously published on this problem. Tebutt's critical observations indicate that a drop in temperature took place after use of high frequency current and infra-red radiation. Gale noted a rise of approximately 0.5 degrees after use of short waves. According to Andreen and Osborne the heating degree of diathermy is only less than the electromagnetic field and short waves next to last in efficiency — a discrepancy in need of further evaluation.) — Editor.

X-Ray Treatment of Inflammatory Ailments. (Zur Röntgenbehandlung entzündlicher Erkrankungen.) G. Kharmandaryan.

Strahlentherapie **57**:187, 1936.

The author introduced x-ray treatment of several inflammatory conditions, among these being inflammatory affections of the oral cavity, parotitis, paraproctitis, mastitis, whitlow, furunculosis, erysipelas, strepto-folliculitis. The treatment is carried out with comparatively small dosage. (Between 10—30 H E D, 150 K V, Filter 5 mm. Al, or 0.5 mm. Cu, 1 mm. Al.) Within that limit of dosage best results are obtained. Higher dosage seems indicated in isolated cases. Strict observation of individual factors is obligatory in the treatment of such processes. In the overwhelming majority of cases the author applied radiation to the inflammatory area (local radiation). In some of the cases the effect he aimed at was brought about in an indirect way

(radiation of the spleen, in case of furunculosis).

Following the first exposure, a temporary exacerbation and resorption of the inflammatory process or ulceration may occur. Drainage may be established to enhance rapid healing. As a rule an early and correct application will cut short the inflammatory process and lead to relief of symptoms. Neglected cases do not respond to irradiation even when continuously exposed. There is an undeniable relationship between the success of x-ray therapy and the general effect of irradiation and local influence exerted on the inflammatory process.

Study of End-Results of Treatment of Amenorrhea and Sterility by Radiation of 128 Married Women Over Period of Twelve Years. Ira I. Kaplan.

Am. J. Obst. & Gynec. **34**:420 (Sept.) 1937.

The author finds that x-ray is of definite value in the treatment of functional disturbances of the ovary and in sterility. Irradiation is applied to the pelvis in most instances and in some cases to the pituitary as well. Whether to treat one or both is a matter of judgment based on training and experience. A number of children born of mothers so irradiated were not abnormal physically or mentally. The menstruation was reestablished in 76 patients of whom 44 later conceived—seventeen conceived more than once, 15 conceived and aborted, two of these aborted twice.

Experiences With Short Wave Therapy in Gynecology. (Erfahrungen mit der Kurzwellentherapie gynakologischer Erkrankungen). Frithjof Lieburg.

Deutsche med. Welt. **10**:1511, 1936.

In the cases treated inflammatory processes predominated. With few exceptions complete relief was attained by short wave treatment. A striking feature in most cases was the speedy alleviation of pain. Conditions presenting especial indications are: Parametritis and mastitis. In about 80 per cent of cases of acute and chronic unspecified diseases of the adnexa complete success or at least essential retrogression of the local findings was observed. In acute gonococcal disease the results were not quite as favorable but more or less pronounced changes were found after prolonged treatment. In the majority of cases of pyosalpingitis the author was not successful, one case even terminating fatally by sepsis. Post mortem examination revealed right sided pyosalpingitis with perforation into the small pelvis and bladder. Fresh fibrinous peritonitis was present. In the author's opinion it was a matter of activating the bacteria through short wave treatment, which was responsible for perforation into the peritoneum.

Small cystic, degenerated ovaries as well as lumbago, were favorably influenced, except when the underlying pathologic findings were of a grave nature.

In the author's opinion short waves are adaptable also for the treatment of acute processes, in contrast to conventional diathermy. This is all the more gratifying as the patients may benefit also in the sense of alleviation of pain. Certain precautions must be taken. Dosage must be accurate. Should any symptoms of irritation appear, treatment must be stopped at once.

Iontophoresis, in Chronic Cystitis. (Die Jontophorese der mit medikamentöser Flüssigkeit gefüllten Harnblase bei chronischer Zystitis.) Hans Hirsch.

Wien. med. Wchnschr. **86**:1113, 1936.

Iontophoresis of the urinary bladder filled with a medicinal liquid by means of electrodes attached from the outside is a new method of treating hollow organs. The author used a methylene blue solution (1:2000) in the bladder. According to the position of the cathode a certain direction may be given to the dispersion of the dye. Previous or simultaneous diathermy enhances the deep effect. The author achieved good results with this procedure, especially in chronic cysititis. A special electrode he used consisted of several layers of heavy tinfoil which are covered with muslin. The electrode is placed against the perineum in order to affect the vesical floor and the posterior urethra by the electric current. Marked improvement took place after a few exposures. The author's experiences with chronic cystitis suggest the use of iontophoresis as treatment of other hollow organs of the body that can be filled from the outside, e. g., the stomach, large intestine, rectum, pelvis of the kidneys. The selection of suitable medicines presents no difficulties.